THE

AMERICAN

JOURNAL OF PSYCHOLOGY

EDITED BY

G. STANLEY HALL

EDMUND CLARK SANFORD

EDWARD BRADFORD TITCHENER

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OHIO STATE UNIVERSITY

VOL. XXIII

ALBANY, N. Y. AND WORCESTER, MASS.

FLORENCE CHANDLER, Publisher

1912

BF1
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THE AMERICAN

JOURNAL OF PSYCHOLOGY

Founded by G. Stanley Hall in 1887

Vol. XXIII JANUARY, 1912 No. 1

THE RELATIVE LEGIBILITY OF DIFFERENT FACES OF PRINTING TYPES

By Barbara Elizabeth Roethlein, A.M., Clark University

Communicated by John Wallace Baird

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I. INTRODUCTORY

The aim of the investigation which is here reported was to determine the relative ease or difficulty with which various 'faces'[1] or forms of printed letters can be read; and to discover what relationship obtains between legibility and certain definite modifications of 'face.' A number of typically different faces of type were selected for investigation; and our experimental procedure consisted essentially in determining to what extent the legibility of each face was affected —both when the letters were presented in isolation and in groups—by the introduction of unfavorable conditions for

[1] The term 'face' is employed here and throughout this paper in the sense in which it has come to be used by printers and type-founders. It is customary to group the numerous variants of letter-form into families,—Caslon, Cheltenham, Jenson, Ronaldson, etc.,—and to speak of each family or typical variant from the common letter-form as a 'face.'

reading. The present paper will deal only with 'type-faces' ; the question of the part which is played by printing papers and printing inks will be discussed in a later paper.

At the time when the art of printing from individual or moveable types was first introduced, the forms of the letters of the alphabet were few in number and exceedingly crude in design. The use of 'black letter' had been popularized by generations of manuscript writers; and the early printers were content to appropriate those letter-forms which they found to be in current use. But within a few decades designers and draughtsmen set themselves the task of simplifying and improving the existing forms of letters; and, indeed, it seems probable that the Roman 'faces' were introduced about the year 1465, and the Italic 'faces' some thirty-five years later. The ingenuity of many generations of mediaeval and modern designers has produced a multitude of variants of letter-forms, many of which are familiar to every reader (a, a, a, a, a; g, g, g, g, g). Hundreds of different 'faces' of type have been designed and put upon the market; and while it is true that certain of these 'faces' are employed only for purposes of ornamentation and display, yet an enormous variety of letter-forms is to be found in our books and magazines. Every reader has observed that all of these variants of letter-form are not equally legible—an observation which raises the theoretical question: What are the factors upon which legibility depends? And the practical question: How should one proceed if one set out to improve the legibility of printed letters?

II. HISTORICAL

Psychologists have been engaged these many years in an investigation of the act of reading in its various aspects. But there is a singular dearth in the literature so far as the specific topic of the present investigation is concerned.

More than forty years ago, Exner (17) and Baxt (2) undertook to measure the brief period of time which is necessary for the perception of visual objects (letters, words); and in 1885 Cattell (6, 7, 8) continued the investigation of the same problem. Baxt had reported that, under his most favorable conditions of illumination, it was possible to read two or three letters of a total group of seven when they were exposed for one one-hundredth of a second. Cattell devised a falling-screen apparatus which enabled him to vary and to measure his exposure-times. He found that the differences in the times which are necessary for the recognition of isolated letters, whether upper case or lower

case,[2] whether Latin or German, are of negligible magnitude. When the exposure-time was very brief, it was found that the letters were not always read correctly. A record of the percentage of correct readings of the various letters, when presented under constant and uniform conditions, enabled Cattell to determine the relative legibility of the letters. The order of legibility (descending) was found to be: W Z M D H K N X A Y O G L Q I S C T R P B V F U J E and d k m q h b p w u l j t v z r o f n a x y e i g c s,—W being read correctly in 89 per cent. of the trials, E in 23 per cent.; d in 87, and s in 28 per cent.

Sanford (35) employed a similar method, but obtained a somewhat different result; his order was (for Snellen type, lower case):

m w d q v y j p k f b l i g h g r x t o u a n e s c z

Sanford also determined the relative legibility of the same letters by a distance method, and obtained the following result:

w m q p v y j f h r d g k b x l n u a t i z o c s e

Sanford also tested alphabets representing two other letter-forms,—a modern face, and a bold oldstyle face. The modern face letters were recognized in the following order (distance test):

d p q m y k n w o g v x h b j l i a t u z r s c f e

The oldstyle letters fell into the following order (tested by the method of brief exposure):

m w p q v y k b d j r l o n i g h u a t f s x z c e

Finzi (18) employed the method of brief exposure, presenting a group of nine letters at each exposure. From the percentage of misreadings of each letter he computed the order of legibility as follows:
P U A Q X T D S E W M V Y Z H C N F L R G B K O I,
the percentage of errors ranging between .8 for P, and 7.8 for I. The particular type or letter-form which Finzi employed is not specified in his paper.

Griffing and Franz (21) investigated the influence of size and form of letter upon legibility. Their experiments comprised a fourfold test: What is the difference in the rapidity with which small print and large print can be read (five-point and twelve-point, both Roman)? How many letters of each of these two sizes can be read in a single brief exposure? How long must letters of each size be exposed

[2] The term 'upper case' will be used throughout to designate the capital letters, and 'lower case' to designate the small letters.

in order to insure their correct reading? What intensity of illumination is necessary for the recognition of letters of various forms and sizes,—Roman letters, .8 mm. and 1.6 mm. high; Gothic letters, .9, 1.6, 3.1, and 6.0 mm. high? These investigators found that their larger types were, in every instance, more legible than their smaller types; and that Gothic letters were more legible than Roman letters.

Besides these experiments which have just been described, numerous attempts have been made to investigate other factors which have to do with the act of reading. The nature and the extent of the eye-movements by means of which the reader follows the printed line have been examined and measured by Huey (*22, 23, 24*), Dodge (13, 14, 15), Erdmann and Dodge (16), Dearborn (10), and others. It has been established that the movement of the reader's eyes does not proceed gradually and continuously across the page, in any such fashion as, for example, a meteor moves across the sky. Typical eye-movements consist of a succession of alternate leaps and pauses; nor is the movement always in a forward direction, because it frequently happens that one's eye-movement proceeds backward, i.e., to the left, from an intermediate fixation-point. The number of pauses may vary from two to seven in a line whose length is twenty centimeters; but the usual distance between successive fixation points or pauses is approximately 2 cm. It seems probable that no words are seen while the eyes are in movement; and that the act of reading a printed line consists of a series of interrupted glimpses, during each of which one reads a small section which extends to the right and to the left of the fixation-point.

This discovery makes it seem probable that a considerable part of the printed line is imaged, not upon the fovea, but upon para-foveal regions of the retina. And the capacity of these paracentral regions to distinguish the forms of letters becomes an important topic for investigation. This problem has, indeed, been attacked by Kirschmann (28) and by Dockeray (12); but further investigation is needed before one can make any definite statement regarding the legibility of letters in indirect vision.

Numerous other investigations of the problems of reading have been made by Babbage (1), Becher (4), Goldscheider and Müller (19), Javal (26, 27), Maire (31), Messmer (32), Pillsbury (33), Quantz (34), Schumann (37), and Zeitler (40); but it seems more appropriate to discuss their results in connection with our own findings, than to summarize them in this section.

III. EXPERIMENTAL

A. ISOLATED LETTERS

a. Materials and Apparatus

The materials which were employed in the present investigation were sheets of printed letters; and the apparatus consisted of a mechanism by means of which these letters could be presented at a variable distance from the observer.

When the investigation was first undertaken, we made a careful examination of the various faces of type which are listed in the sample-books of the American Type Founders Company.[3] We selected fifty faces of type,—comprising some thirty ordinary faces, together with such variants as italic, bold, condensed, expanded and various combinations of these variants.

In these earlier experiments, it was decided to employ the method of brief exposure; and an apparatus was devised which provided for a succession of exposures, each one one-thousandth of a second in duration. The series of exposures of any given letter was terminated by the depression of a key by the observer; and an automatic counting device recorded the number of exposures which had been necessary for the reading of the letter. For certain technical reasons this apparatus and mode of procedure were abandoned after a number of preliminary experiments had been made; and the distance test was substituted.[4]

The apparatus, by means of which we obtained the results on which this paper is based, consisted of a long bench along which moved a sliding carriage containing the letters to be read. The bench was 440 cm. long and 15 cm. wide. Its

[3] The author is indebted to the American Typefounders Company, Jersey City, for a liberal donation of types and of prints, without which the investigation would have been impossible. Especial thanks are due to Messrs. Frank B. Berry, L. B. Benton and Morris Benton of that firm for valuable suggestions regarding letter-forms and regarding the interpretation of our results. We are also under obligation to Dr. H. L. Koopman, of Brown University, and to Mr. C. Chester Lane of the Harvard Press; Mr. L. D. Evans of the Riverside Press, Cambridge, Mass., has furnished us with valuable data concerning compositors' errors and proof-readers' errors.

[4] It is a well-known fact that concentration of attention has a very pronounced effect upon reaction-time, and that the duration of the reaction varies with variations in degree of concentration. It seemed difficult, even impossible, to maintain the same degree of concentration through thousands of readings of letters; and, in the absence of a control of this exceedingly influential factor, the results of our tachistoscopic experiments seemed wholly unreliable. For this reason the tachistoscope was abandoned, and a method which consisted in presenting the letters at variable distances was substituted.

proximal end was 78 cm., and its distal end 63 cm. above the floor, so that the observer was able to assume the primary position of regard throughout. The higher end of the bench was provided with a vertical support, which carried a head rest,—the hood of a stereoscope. This device enabled the observer to assume and to maintain a constant position in relation to any point on the scale upon the side of the bench.

The carriage which moved along the bench consisted of a box 55 cm. high, 40 cm. wide, and 25 cm. deep. The front of the box had been cut away; and the back consisted of a wooden wall against which the sheet of printed letters was attached and held in place by a sheet of glass. The back wall of the box was illuminated by a number of electric lamps, so arranged that the whole surface of the sheet of letters was uniformly illuminated. To the side of the carriage was attached an indicator, which just cleared a metric scale upon the side of the bench; this device enabled the experimenter to ascertain the distance of the sheet of letters from the eye of the observer at any given setting of the carriage.

The sheets upon which the isolated letters were printed were 21 cm. wide and 36 cm. long; and the paper of all of the sheets was of the same quality and texture.[5] Each sheet contained twenty-eight letters, all of the same face and of the same case,—the complete alphabet, with two of its letters repeated. The letters were arranged in random sequence, in four lines; they were so spaced that each letter stood at a distance of 3.7 cm. from its nearest neighbors on the same and on adjacent lines. Fifty-two different sheets of letters were investigated, representing the following twenty-six faces of type, both lower case and upper case. All of our letters were of the size which is technically described as ten-point; the reader will find them illustrated in Tables I and II. (See inserts between pages 8 and 9.)

American Typewriter
Bold Antique
Bulfinch
Caslon Oldstyle No. 540
Century Oldstyle
Century Oldstyle, Bold
Century Expanded
Cheltenham Oldstyle
Cheltenham Bold

[5] This paper is technically described by the manufacturers as a white, coated book-paper, 25 x 30—80.

Cheltenham Bold, Condensed
Cheltenham Italic
Cheltenham Wide
Clearface
Clearface Bold
Clearface Italic
Clearface Bold Italic
Cushing No. 2
Cushing Oldstyle No. 2
Cushing Monotone
Della Robbia
DeVinne No. 2
DeVinne No. 2, Italic
Franklin Gothic
Jenson Oldstyle No. 2
News Gothic
Ronaldson Oldstyle No. 551

b. Method of Procedure

All of the readings were made in a semi-darkened room, in order that the (artificial) illumination upon the sheet of letters might be controlled and kept constant throughout. The experimental procedure was as follows: After the observer had become adapted to the illumination of the room, a sheet of letters was placed in position in the carriage and the series of readings began with the carriage at the farther end of the bench. The observer had been instructed to read the letters at a uniform tempo, substituting "blank" for the name of any letter which was not easily decipherable. This precaution seemed necessary to prevent the observer from giving an undue amount of attention to any one letter of the series at the expense of the other letters, i. e., to prevent him from puzzling longer over one member of the series than over any other member. After he had thus attempted to read through the complete list of letters, the carriage was moved to a point twenty centimeters nearer his eye than the initial setting; and he made a second attempt to read the letters. In the first and alternate readings of each series he began at the upper left-hand corner of the sheet and proceeded from left to right along each line, taking the lines, in order, from the top downward. In the second and alternate readings, he began at the lower right-hand corner of the sheet and proceeded from right to left, and from below upwards. This procedure was continued, the carriage being advanced step by step, until every letter upon the sheet had been identified. The experimenter was provided with

a duplicate sheet of letters, similar to the one which had been inserted in the carriage; and upon this duplicate sheet she recorded the misreadings, and the farthest distance at which each letter was read.

Each of the fifty-two sheets of letters was read twice by each of the six observers. Before being inserted in the carriage for its second reading, each sheet was cut along its longitudinal and its transverse diameters; and the four quarter-sheets were reassembled in such fashion that those letters which had formerly appeared upon the marginal regions of the original sheet now appeared upon central regions of the reconstructed sheet, and *vice versa*. A period of several days always elapsed between the first and the second reading of any sheet.

c. Observers

The observers were instructors or students in the department: Messrs. R. Acher, J. W. Baird, E. O. Finkenbinder, F. A. Lombard, H. B. Moyle, and C. W. St. John; they all possessed emmetropic or adequately corrected vision. Each observer gave a complete series of one hundred and four readings.

B. GROUPED LETTERS

In the second group of experiments the apparatus and the method remained unchanged, but here the letters were presented in groups instead of singly. In these later experiments only lower case letters were employed. Eight faces were elected from the twenty-six which had already been used, and Scotch Roman was added,—the complete list of nine faces being as follows:

Bulfinch
Caslon Oldstyle No. 540
Century Oldstyle
Century Expanded
Cheltenham Wide
Cushing Oldstyle No. 2
Cushing Monotone
News Gothic
Scotch Roman

Each group of letters formed a nonsense combination; and the groups of each face were arranged in three lines upon sheets of the same size as had been employed in the former experiments. Sets of grouped letters were printed, in duplicate, upon coated book paper, of the same quality

THIS CHART WILL BE THE FIRST CHART
APPEARING AT THE END OF THIS FILM

as the inserts opposite page 79 of this issue of the JOURNAL, and upon an antique laid book paper of the same quality and weight as the paper of this page.

Our mode of grouping the letters aimed to introduce as many difficult and confusing combinations of letters as possible. We were guided in the combining of the letters into groups by data furnished by Mr. L. D. Evans, an expert proofreader, and by the confusions which had been recorded in our earlier experiments. The combinations of letters which are here appended illustrate a typical series of groups; they also illustrate the Scotch Roman face.

ksitugy cdzxpbj ftoceygqa wrvlindh
hknurfkxzqg munimm bhwvjyst oceo
wvxarlizxp ybhdonactilsf dnupqcetrlj

Only three observers, Messrs. Baird, Finkenbinder and St. John, took part in these experiments. Each observer gave two readings of each face,—an average of twenty-four readings of each letter of each face.

d. Results

A. ISOLATED LETTERS

The experimenter's record-sheet contained a statement of the distance at which each letter was read, together with a list of the confusions or misreadings, and an introspective description of the procedure which the observer had followed in deciphering the letters. The numerical data have been compiled and tabulated in various ways.

Tables I and II show the averages of the numerical results, arranged in order of faces. These two tables report the data for 'ordinary' faces only,—the italic, the bold and the condensed faces not being included here. The numbers which appear in these tables indicate the averages of the extreme distances at which the letters were read,—hence the larger the number appended to any letter, the greater the legibility of that letter. Thus, in the first column of Table I, "H 190, I 230" may be taken to signify that the upper case I of the American Typewriter face is considerably more legible than the upper case H of the same face.

Each vertical column of these two tables contains, therefore, a statement of our findings regarding the relative legibility of the various letters of a given face; and the number at the foot of the column indicates the average legibility of the twenty-six letters of that face. The numbers in each horizontal line of the tables indicate the relative legibility

of each of the sixteen variants of each of the twenty-six letter forms.

Table III presents the grand averages of the sixteen faces; it also contains similar data for the bold and for the italic faces and for two extra-bold faces, Franklin Gothic and Bold Antique; while Table IV shows the grand average distance at which each letter of the alphabet was read, the data being here compiled from the readings of the complete set of sixteen faces.

The effect of certain definite modifications of a given letter-form is shown in Tables V and VI. Th.se two tables are compiled from results which were obtained with Cheltenham Old-style presented in ordinary, in bold, in bold-condensed, (in wide,) and in italicized form.

Tables VII, VIII, IX, and X show the five variants of each letter which proved to be most legible, and the five which proved to be least legible.

B. GROUPED LETTERS

The results of our second series of experiments are presented in Tables XI and XII. Table XI shows the average distance at which each letter of each of the nine faces was read when presented in groups. The reader is warned against drawing any conclusion from this table regarding the relative legibility of the various letters of any given face, e.g., regarding the relative legibility of the Caslon m and the Caslon, or any other, k. In other words, the numbers which appear in the horizontal lines are comparable with one another; but the numbers which appear in the vertical columns are incomparable with one another. Table XII presents the same results as are contained in Table XI, but they are now arranged in order of magnitude in order to show the (descending) order of legibility of the several variants of each letter-form.

IV. DISCUSSION OF RESULTS

A. ISOLATED LETTERS

The problem with which we are here concerned may be given the following general formulation: Which of several geometrical figures is most clearly perceptible, and most readily distinguishable from other geometrical figures? But while the twenty-six letter-forms which constitute the alphabet may be regarded as a series of geometrical figures of different shapes and of different degrees of complexity of detail, and while any twenty-five of the different twenty-six

THIS CHART WILL BE THE
SECOND CHART APPEARING
AT THE END OF THIS FILM

TABLE III. ISOLATED LETTERS

A Comparison of the Average Legibility of Various Faces. Order of Legibility

UPPER CASE		Lower Case	
The Sixteen Roman Faces			
JENSON	281.7	News Gothic	236.4
BULFINCH	273.8	Bulfinch	233.6
CHELT. W.	268.5	Clearface	229.5
CENTURY O. S.	270.4	Century O. S.	228.0
CLEARFACE	269.3	Century Exp.	226.7
CHELT. O. S.	268.5	Chelt. W.	224.3
DELLA ROBBIA	266.8	Jenson	214.7
NEWS GOTHIC	264.6	Della Robbia	214.2
CENTURY EXP.	264.8	Cushing O. S.	212.6
CASLON O. S.	250.7	Ronaldson	209.2
CUSHING O. S.	247.6	Chelt. O. S.	206.4
DE VINNE NO. 2	243.2	De Vinne No. 2	204.8
RONALDSON	241.7	American Typewr.	201.7
CUSHING MON.	228.4	Caslon O. S.	201.7
CUSHING NO. 2	224.8	Cushing Mon.	190.6
AMERICAN TYPEWR.	196.8	Cushing No. 2	185.6
Average	252.8	*Average*	213.7
Bold Faces			
CENT. O. S. BOLD	296.0	Cent. O. S. Bold	255.1
CHELT. O. S. BOLD	286.2	Chelt. O. S. Bold	233.4
CLEARFACE BOLD	273.7	Clearface Bold	230.5
Average (Bold)	285.3	*Average* (Bold)	239.7
Italic Faces			
CLEAR. ITALIC	274.3	*Clear. Italic*	231.2
CHELT. ITALIC	259.6	*Chelt. Italic*	203.8
DE VINNE ITALIC	235.5	*De Vinne Italic*	201.9
Average (Italic)	256.5	*Average* (Italic)	212.3
Average (of same faces, Roman)	260.3	*Average* (of same faces, Roman)	213.6
Bold Italic Face			
CLEAR. B. ITALIC	265.4	*Clearface B. Italic*	213.2
Extra Bold Faces			
BOLD ANT.	307.4	Bold Antique	260.5
FRANK. GOTHIC	284.8	Franklin Gothic	245.2

TABLE IV. ISOLATED LETTERS

THE RELATIVE LEGIBILITY OF THE LETTERS OF THE ALPHABET. (AVERAGE OF SIXTEEN FACES; 192 READINGS OF EACH LETTER)

UPPER CASE		Lower Case	
W	300.2	m	296.8
M	293.8	w	261.6
L	291.1	d	254.3
J	287.5	j	239.4
I	280.4	l	236.3
A	272.4	p	236.1
T	268.9	f	233.0
C	265.1	q	226.4
V	263.5	y	224.6
Q	261.7	i	224.1
P	257.9	h	222.7
D	254.3	g	220.6
O	254.0	b	217.8
Y	252.1	k	216.9
U	251.3	v	213.1
F	241.6	r	203.6
H	240.5	t	199.6
X	239.8	n	195.7
G	237.6	c	193.8
N	235.5	u	193.1
Z	233.8	o	190.1
K	231.7	x	181.7
E	223.9	a	177.0
R	214.0	e	173.5
B	208.9	z	171.6
S	205.7	s	152.6
Average	252.8	*Average*	213.8

TABLE V. UPPER CASE

THE EFFECT OF VARIOUS MODIFICATIONS OF A GIVEN FACE

Cheltenham

Ordinary	Bold	Bold Condensed	Wide	Italic
A 291.7	**A** 303.3	**A** 190.0	*The Upper Case letters of Cheltenham Wide are identical with those of Cheltenham Old Style (First Column of this Table).*	*A* 273.3
B 210.0	**B** 236.7	**B** 204.2		*B* 220.0
C 290.0	**C** 295.0	**C** 253.3		*C* 283.3
D 270.0	**D** 284.2	**D** 260.0		*D* 261.7
E 259.2	**E** 273.3	**E** 225.8		*E* 237.5
F 241.7	**F** 281.7	**F** 239.2		*F* 235.0
G 275.0	**G** 280.0	**G** 232.5		*G* 240.0
H 256.7	**H** 295.0	**H** 213.3		*H* 263.3
I 268.3	**I** 306.7	**I** 273.3		*I* 270 0
J 281.7	**J** 295.0	**J** 290.0		*J* 276.7
K 254.2	**K** 277.5	**K** 234.2		*K* 240.8
L 300.0	**L** 311.7	**L** 280.0		*L* 288.3
M 303.3	**M** 321.7	**M** 295.0		*M* 301.7
N 261.7	**N** 270.0	**N** 216.7		*N* 256.7
O 278.3	**O** 295.0	**O** 243.3		*O* 280.0
P 270.8	**P** 293.3	**P** 240.8		*P* 286.7
Q 291.7	**Q** 300.0	**Q** 258.3		*Q* 286.7
R 255.0	**R** 253.3	**R** 205.0		*R* 244.2
S 215.0	**S** 228.2	**S** 187.5		*S* 206.7
T 271.2	**T** 306.7	**T** 271.7		*T* 258.3
U 266.7	**U** 298.3	**U** 240.0		*U* 263.3
V 288.3	**V** 305.0	**V** 254.2		*V* 240.8
W 306.7	**W** 323.3	**W** 300.0		*W* 278.3
X 263.3	**X** 270.0	**X** 255.0		*X* 242.5
Y 249.2	**Y** 273.3	**Y** 256.7		*Y* 245.0
Z 261.7	**Z** 263.3	**Z** 235.0		*Z* 268.3
Average 268.5	286.2	248.2		259.6

TABLE VI. LOWER CASE

THE EFFECT OF VARIOUS MODIFICATIONS OF A GIVEN FACE

Cheltenham

Ordinary		Bold		Bold Condensed		Wide		Italic	
a	155.0	**a**	195.8	**a**	167.5	a	190.8	*a*	159.2
b	221.7	**b**	221.7	**b**	209.2	b	245.0	*b*	195.0
c	180.8	**c**	198.3	**c**	185.8	c	200.8	*c*	192.5
d	261.7	**d**	285.0	**d**	275.0	d	276.7	*d*	263.3
e	169.2	**e**	185.8	**e**	170.8	e	185.8	*e*	165.0
f	235.0	**f**	244.2	**f**	214.2	f	241.7	*f*	261.7
g	195.8	**g**	222.5	**g**	202.5	g	216.7	*g*	216.7
h	211.7	**h**	251.7	**h**	238.3	h	238.3	*h*	241.7
i	235.0	**i**	226.7	**i**	206.7	i	251.7	*i*	251.7
j	234.2	**j**	280.0	**j**	246.7	j	248.3	*j*	222.5
k	211.7	**k**	225.8	**k**	244.2	k	224.2	*k*	217.5
l	240.0	**l**	270.0	**l**	231.7	l	254.2	*l*	230.0
m	295.0	**m**	301.7	**m**	273.3	m	315.0	*m*	273.3
n	181.7	**n**	217.5	**n**	175.8	n	208.3	*n*	198.3
o	181.7	**o**	192.5	**o**	160.0	o	189.2	*o*	169.2
p	223.3	**p**	255.0	**p**	225.8	p	247.5	*p*	223.3
q	221.7	**q**	255.0	**q**	205.8	q	219.2	*q*	196.7
r	187.5	**r**	223.3	**r**	199.2	r	214.2	*r*	205.8
s	138.3	**s**	140.8	**s**	135.8	s	160.0	*s*	131.7
t	183.3	**t**	222.5	**t**	208.3	t	190.0	*t*	192.5
u	177.5	**u**	217.5	**u**	170.8	u	197.5	*u*	179.2
v	205.0	**v**	263.3	**v**	208.3	v	223.3	*v*	158.3
w	263.3	**w**	300.0	**w**	261.7	w	293.3	*w*	245.0
x	169.2	**x**	190.8	**x**	185.0	x	184.2	*x*	174.2
y	222.5	**y**	245.0	**y**	224.2	y	236.7	*y*	174.2
z	164.2	**z**	175.8	**z**	154.2	z	179.2	*z*	160.0
Average	206.4		233.4		205.9		224.3		203.8

TABLE VII. THE FIVE MOST LEGIBLE ALPHABETS. UPPER CASE

THE FIRST COLUMN CONTAINS THE "IDEAL ALPHABET"; OR THE FACES WHICH PROVED TO BE MOST LEGIBLE; THE

TABLE VII. THE FIVE MOST LEGIBLE ALPHABETS. UPPER CASE

THE FIRST COLUMN CONTAINS THE "IDEAL ALPHABET"; OR THE FACES WHICH PROVED TO BE MOST LEGIBLE; THE SECOND COLUMN GIVES THE FACES WHICH RANKED SECOND IN ORDER OF LEGIBILITY, ETC.

A	Century Exp.	300	A	Century O. S.	300	A	Jenson	300	A	Della Robbia	293.3	A	Chelt. O. S.	291.7
B	Bulfinch	231.7	B	News Gothic	230.8	B	Jenson	229.2	B	Clearface	221.7	B	Century O. S.	221.7
C	Jenson	310	C	Bulfinch	293.3	C	Chelt. O. S.	290	C	Clearface	288.8	C	Century O. S.	285
D	Jenson	300	D	Century O. S.	281.7	D	Bulfinch	275	D	Century Exp.	273.3	D	Chelt. O. S.	270
E	Chelt. O. S.	259.2	E	Jenson	245.8	E	Century O. S.	241.7	E	Century Exp.	240.8	E	News Gothic	240
F	Jenson	276.7	F	Clearface	270.7	F	Century Exp.	265.8	F	Century O. S.	265	F	Bulfinch	254.2
G	Bulfinch	276.7	G	Chelt. O. S.	275	G	Jenson	273.3	G	Century O. S.	265	G	Clearface	258.6
H	Della Robbia	283.3	H	Jenson	273.3	H	Bulfinch	266.7	H	Clearface	261.2	H	Chelt. O. S.	256.7
I	Clearface	327.2	I	Della Robbia	301.7	I	Bulfinch	300	I	News Gothic	296.7	I	Jenson	296.7
J	Clearface	323	J	Jenson	320	J	Della Robbia	315	J	Century Exp.	301.7	J	Century O. S.	300
K	Jenson	270	K	Bulfinch	262.5	K	Century O. S.	256.7	K	Chelt. O. S.	254.2	K	DeVinne No. 2	243.3
L	Clearface	315.1	L	Jenson	311.7	L	Century O. S.	308.3	L	Bulfinch	305	L	Century Exp.	301.7
M	Clearface	323	M	Della Robbia	321.8	M	Jenson	318.3	M	Bulfinch	316.7	M	Cushing O. S.	315
N	Jenson	270	N	Chelt. O. S.	261.7	N	Della Robbia	258.3	N	Century O. S.	258.3	N	Clearface	247
O	Jenson	296.7	O	Century O. S.	293.3	O	Bulfinch	293.3	O	Chelt. O. S.	278.3	O	Della Robbia	275
P	Bulfinch	301.7	P	Jenson	296.7	P	Clearface	286	P	Century Exp.	281.7	P	News Gothic	278.3
Q	Bulfinch	308.3	Q	Jenson	295	Q	Chelt. O. S.	291.7	Q	Clearface	285	Q	News Gothic	278.3
R	Chelt. O. S.	255	R	News Gothic	240	R	Century Exp.	235	R	Jenson	234.2	R	Della Robbia	228.3
S	Bulfinch	236.7	S	Century O. S.	225	S	Jenson	223.3	S	News Gothic	216.7	S	Chelt. O. S.	215
T	Jenson	308.3	T	Century O. S.	305	T	Della Robbia	295	T	News Gothic	280.8	T	Cushing O. S.	280
U	Century Exp.	276.7	U	Della Robbia	275	U	News Gothic	273.3	U	Jenson	270.8	U	Clearface	269.1
V	Jenson	310	V	Della Robbia	291.7	V	Chelt. O. S.	288.3	V	Century O. S.	281.7	V	Century Exp.	278.3
W	Della Robbia	343.3	W	Century O. S.	331.7	W	Clearface	318.2	W	Century Exp.	316.7	W	News Gothic	316.7
X	Chelt. O. S.	263.3	X	Bulfinch	260.8	X	Century O. S.	257.5	X	Jenson	256.7	X	Della Robbia	252.5
Y	Century O. S.	271.7	Y	Bulfinch	268.3	Y	Clearface	266	Y	Della Robbia	263.3	Y	Jenson	261.7
Z	Jenson	270	Z	Chelt. O. S.	261.7	Z	Bulfinch	216.7	Z	Della Robbia	256.7	Z	News Gothic	255.8

TABLE VIII. THE FIVE MOST LEGIBLE ALPHABETS. LOWER CASE

THE FIRST COLUMN CONTAINS THE IDEAL ALPHABET; OR THE FACES WHICH PROVED TO BE MOST LEGIBLE; THE SECOND COLUMN GIVES THE FACES WHICH RANKED SECOND IN ORDER OF LEGIBILITY, ETC.

a	Century O. S.	197.5	a	Century Exp.	196.7	a	Chelt. W.	190.8	a	News Gothic	190	a	Bulfinch	185
b	Century O. S.	245	b	Chelt. W.	245	b	News Gothic	245	b	Della Robbia	223.3	b	Clearface	223
c	Clearface	235.9	c	Century O. S.	230	c	News Gothic	221.7	c	Bulfinch	207.5	c	Chelt. W.	200.8
d	Clearface	283.4	d	Chelt. W.	276.7	d	Della Robbia	276.7	d	Century Exp.	273.3	d	Cushing O. S.	260
e	Century O. S.	197.5	e	Jenson O. S.	191.7	e	News Gothic	191.7	e	Century Exp.	187.5	e	Chelt. W.	185.8
f	News Gothic	263.3	f	Bulfinch	261.7	f	Della Robbia	260	f	Century Exp.	256.7	f	Century O. S.	256.7
g	News Gothic	258.3	g	Bulfinch	251.7	g	Clearface	250	g	Century O. S.	245	g	Century Exp.	241.7
h	Clearface	247	h	Bulfinch	241.7	h	Century Exp.	238.3	h	Chelt. W.	238.3	h	Della Robbia	236.7
i	Chelt. W.	251.7	i	News Gothic	249.2	i	Century O. S.	245	i	Bulfinch	243.3	i	Chelt. O. S.	235
j	Century Exp.	283.3	j	News Gothic	280.8	j	Clearface	264.4	j	Am. Typewr.	256.7	j	Chelt. W.	248.3
k	Bulfinch	236.7	k	Century Exp.	235	k	Jenson O. S.	233.3	k	News Gothic	233.3	k	Chelt. W.	224.3
l	Clearface	280.2	l	Bulfinch	258.7	l	Chelt. W.	254.2	l	Century Exp.	252.5	l	Jenson O. S.	251.7
m	Bulfinch	333.3	m	News Gothic	326.7	m	Clearface	325.1	m	Chelt. W.	315	m	De Vinne No. 2	315
n	News Gothic	220	n	Bulfinch	213.3	n	Century O. S.	213.3	n	Clearface	213.7	n	Chelt. W.	208.3
o	Bulfinch	218.3	o	Century Exp.	213.3	o	Century O. S.	211.7	o	News Gothic	207.5	o	Clearface	199.5
p	Bulfinch	271.2	p	Clearface	259.7	p	Jenson O. S.	255	p	News Gothic	248.3	p	Chelt. W.	247.5
q	News Gothic	257.5	q	Century Exp.	250	q	Bulfinch	250	q	Della Robbia	238.3	q	Cushing O. S.	235
r	News Gothic	237.5	r	Century Exp.	226.7	r	Bulfinch	216.7	r	Century O. S.	216.7	r	Clearface	215.4
s	News Gothic	177.5	s	Bulfinch	167.5	s	Century O. S.	167.5	s	Century Exp.	163	s	Chelt. W.	160
t	Bulfinch	230.8	t	Clearface	228	t	News Gothic	223.3	t	Century Exp.	221.7	t	Cushing O. S.	208.3
u	Bulfinch	225	u	News Gothic	215	u	Century O. S.	212.5	u	Clearface	207.4	u	Century Exp.	198.3
v	Bulfinch	240	v	News Gothic	235.8	v	Century O. S.	230	v	Cushing O. S.	225.8	v	Clearface	225.4
w	News Gothic	305	w	Clearface	296	w	Chelt. W.	293.3	w	Cushing O. S.	281.7	w	Della Robbia	280
x	Bulfinch	211.7	x	Century O. S.	200	x	Century Exp.	195	x	News Gothic	193.3	x	Jenson O. S.	192.5
y	News Gothic	246.7	y	Bulfinch	245	y	Jenson O. S.	241.7	y	Clearface	237.5	y	Chelt. W.	236.7
z	News Gothic	197.5	z	Bulfinch	196.7	z	Century O. S.	182.5	z	Chelt. W.	179.2	z	Jenson O. S.	171.7

TABLE IX. THE FIVE LEAST LEGIBLE ALPHABETS. UPPER CASE

THE FIRST COLUMN SHOWS THE LEAST LEGIBLE ALPHABET WHICH COULD BE MADE UP FROM OUR SIXTEEN FACES:

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THE FIRST COLUMN SHOWS THE LEAST LEGIBLE ALPHABET WHICH COULD BE MADE UP FROM OUR SIXTEEN FACES; THE SECOND COLUMN SHOWS THE FACES WHICH RANK SECOND IN ORDER OF ILLEGIBILITY, ETC.

A	Am. Typewr.	221.7	A	Cushing Mon.	234.2	A	Cushing No. 2	241.7	**A**	Cushing O. S.	257.5	A	Ronaldson	263.3
B	Am. Typewr.	176.7	B	Cushing Mon.	179.2	B	Ronaldson	196.7	**B**	Cushing O. S.	204.2	B	Caslon O. S.	206.7
C	Am. Typewr.	195	C	Cushing No. 2	243.3	C	Cushing Mon.	251.7	**C**	Cushing O. S.	259.2	C	Ronaldson	259.2
D	Am. Typewr.	183.3	D	Cushing No. 2	218.3	D	Cushing Mon.	236.7	**D**	Della Robbia	243.3	D	Ronaldson	246.7
E	Cushing Mon.	192.5	E	Am. Typewr.	193.3	**E**	Cushing O. S.	198.3	E	Ronaldson	208.3	E	Cushing No. 2	209.2
F	Am. Typewr.	191.7	F	Cushing No. 2	208.3	F	Caslon O. S.	210.7	F	Cushing Mon.	217.5	**F**	Cushing O. S.	234.2
G	Am. Typewr.	169.2	**G**	De Vinne No. 2	184.2	G	Cushing No. 2	197.5	G	Ronaldson	213.3	G	Cushing Mon.	214.2
H	Am. Typewr.	190	H	Cushing No. 2	202.5	**H**	Cushing O. S.	213.3	H	Cushing Mon.	214.2	**H**	De Vinne No. 2	233.3
I	Am. Typewr.	230	I	Cushing No. 2	244.2	I	Cushing Mon.	256.7	I	Chelt. O. S.	268.3	I	Ronaldson	270
J	Am. Typewr.	226.7	J	Cushing Mon.	260	**J**	De Vinne No. 2	266.7	J	Cushing No. 2	271.2	J	Ronaldson	281.7
K	Am. Typewr.	177.5	K	Cushing Mon.	200	K	Della Robbia	217.5	K	Caslon O. S.	220.8	**K**	Cushing O. S.	228.3
L	Am. Typewr.	248.3	L	Cushing No. 2	261.7	L	Cushing Mon.	266.7	L	Caslon O. S.	281.7	L	Ronaldson	283.3
M	Am. Typewr.	189.2	M	Ronaldson	268.3	M	Cushing No. 2	273.3	M	Cushing Mon.	275	**M**	De Vinne No. 2	290
N	Am. Typewr.	184.2	N	Cushing No. 2	201.7	N	Cushing Mon.	215	N	Cushing O. S.	220	N	Ronaldson	225
O	Am. Typewr.	186.7	O	Cushing No. 2	215	O	Cushing Mon.	219.2	**O**	De Vinne No. 2	226.7	**O**	Cushing O. S.	230.8
P	Am. Typewr.	190	P	Ronaldson	229.2	P	Cushing Mon.	236.7	P	Cushing No. 2	238.3	P	Caslon O. S.	245
Q	Am. Typewr.	217.5	Q	Cushing No. 2	220	**Q**	De Vinne No. 2	224.2	Q	Ronaldson	231.7	Q	Cushing Mon.	245
R	Cushing Mon.	180	R	Am. Typewr.	186.7	**R**	De Vinne No. 2	193.3	R	Cushing No. 2	196.7	R	Cushing O. S.	198.3
S	Am. Typewr.	168.3	S	Cushing No. 2	182.5	S	Cushing Mon.	183.3	S	Caslon O. S.	197.5	**S**	De Vinne No. 2	200
T	Cushing No. 2	219.2	T	Am. Typewr.	220.8	T	Cushing Mon.	237.5	**T**	De Vinne No. 2	251.7	T	Ronaldson	251.7
U	Am. Typewr.	200.8	U	Cushing No. 2	220	U	Cushing Mon.	232.5	**U**	Cushing O. S.	233.3	U	Ronaldson	237.5
V	Am. Typewr.	205	V	Cushing Mon.	236.7	V	Cushing No. 2	237.5	**V**	Cushing O. S.	246.7	V	De Vinne No. 2	248.3
W	Am. Typewr.	165	W	Cushing Mon.	285	W	Cushing No. 2	288.3	W	Caslon O. S.	291.7	W	Ronaldson	301.7
X	Am. Typewr.	192.5	X	Cushing No. 2	212.5	X	Cushing Mon.	222.5	X	Ronaldson	228.3	**X**	De Vinne No. 2	236.7
Y	Am. Typewr.	221.7	**Y**	De Vinne No. 2	225	Y	Cushing Mon.	233.3	Y	Cushing No. 2	241.7	Y	Chelt. O. S.	249.2
Z	Am. Typewr.	187.5	Z	Cushing No. 2	204.2	Z	Cushing Mon.	207.5	Z	Ronaldson	210.7	**Z**	De Vinne No. 2	216.7

TABLE X. THE FIVE LEAST LEGIBLE ALPHABETS. LOWER CASE

THE FIRST COLUMN SHOWS THE LEAST LEGIBLE ALPHABET WHICH COULD BE MADE UP FROM OUR SIXTEEN FACES; THE SECOND COLUMN SHOWS THE FACES WHICH RANK SECOND IN ORDER OF ILLEGIBILITY, ETC.

a	Chelt. O. S. 155	a	Cushing No. 2 155.8	a	Cushing Mon. 155.8	a	Della Robbia 167.5	a	Ronaldson O.S.169.2
b	Cushing No. 2 171.7	b	Caslon O. S. 190	b	De Vinne No. 2 195.8	b	Cushing Mon. 203.3	b	Cushing O. S. 206.7
c	Am. Typewr. 168.3	c	Cushing Mon. 171.7	c	Cushing No. 2 174.2	c	Cushing O. S. 179.2	c	Della Robbia 181.7
d	Cushing No. 2 205.8	d	Am. Typewr. 230	d	Cushing Mon. 233.3	d	Ronaldson O.S.245	d	Jenson O. S. 246.7
e	Cushing No. 2 140	e	Cushing Mon. 146.7	e	Am. Typewr. 162.5	e	Cushing O. S. 164.2	e	Ronaldson O.S.165
f	Cushing Mon. 178.3	f	Cushing No. 2 184.2	f	De Vinne No. 2 205	f	Jenson O. S. 225	f	Caslon O. S. 225
g	Caslon O. S. 182.5	g	De Vinne No. 2 191.7	g	Chelt. O. S. 195.8	g	Ronaldson O.S.198.3	g	Jenson O. S. 202.5
h	Cushing No. 2 190.8	h	Cushing Mon. 200	h	De Vinne No. 2 205	h	Am. Typewr. 207.5	h	Caslon O. S. 210.7
i	Cushing No. 2 200	i	Ronaldson O.S.204.2	i	Am. Typewr. 206.7	i	Caslon O. S. 209.2	i	De Vinne No. 2 214.2
j	Cushing Mon. 298.3	j	Della Robbia 210.7	j	Jenson O. S. 210	j	Cushing No. 2 218.3	j	Cushing O. S. 227.5
k	Cushing No. 2 183.3	k	Am. Typewr. 188.3	k	Caslon O. S. 197.5	k	Cushing Mon. 200	k	Della Robbia 206.7
l	Cushing Mon. 197.5	l	De Vinne No. 2 190.8	l	Cushing No. 2 208.3	l	Caslon O. S. 219.2	l	News Gothic 221.7
m	Am. Typewr. 195	m	Cushing No. 2 273.3	m	Cushing Mon. 276.7	m	Century Exp. 286.7	m	Caslon O. S. 291.7
n	Cushing No. 2 162.5	n	Cushing Mon. 164.3	n	Cushing O. S. 172.5	n	Chelt. O. S. 181.7	n	Caslon O. S. 190
o	Cushing No. 2 170	o	De Vinne No. 2 170.8	o	Cushing O. S. 172.5	o	Cushing Mon. 175	o	Ronaldson O.S.180
p	Cushing Mon. 200.8	p	Cushing No. 2 205	p	Ronaldson O.S.217.5	p	Caslon O. S. 220.8	p	Chelt. O. S. 223.3
q	Cushing No. 2 196.7	q	Cushing Mon. 206.7	q	De Vinne No. 2 212.5	q	Ronaldson O.S.217.5	q	Chelt. W. 219.2
r	Cushing No. 2 175.8	r	Ronaldson O.S.181.7	r	Cushing Mon. 183.3	r	Chelt. O. S. 189.2	r	Della Robbia 190
s	Chelt. O. S. 138.3	s	Della Robbia 138.3	s	Ronaldson O.S.141.8	s	Caslon O. S. 143.3	s	Cushing No. 2 145.5
t	Cushing No. 2 169.2	t	Cushing Mon. 179.2	t	Caslon O. S. 180.8	t	Chelt. O. S. 183.3	t	Jenson O. S. 188.3
u	Cushing Mon. 165	u	Cushing O. S. 175.8	u	Cushing No. 2 176.7	u	Chelt. O. S. 177.5	u	Jenson O. S. 180
v	Cushing No. 2 183.3	v	Caslon O. S. 180.8	v	Am. Typewr. 195	v	De Vinne No. 2 199.2	v	Chelt. O. S. 205
w	Am. Typewr. 183.3	w	Cushing No. 2 200.8	w	Cushing Mon. 233.3	w	Caslon O. S. 243.3	w	De Vinne No. 2 248.3
x	Cushing Mon. 155	x	Cushing No. 2 157.5	x	Chelt. O. S. 169.2	x	Ronaldson O.S.170	x	Caslon O. S. 171.7
y	Cushing No. 2 194.2	y	Cushing Mon. 195.8	y	De Vinne No. 2 208.3	y	Ronaldson O.S.210.7	y	Century Exp. 218.3
z	Cushing Mon. 143.3	z	Cushing No. 2 156.7	z	Cushing O. S. 157.5	z	Am. Typewr. 159.2	z	Caslon O. S. 162.5

TABLE XI. THE AVERAGE LEGIBILITY OF GROUPED LETTERS

THE NUMBERS IN THIS TABLE INDICATE THE AVERAGE DISTANCE AT WHICH EACH LETTER OF EACH FACE WAS READ. NINE FACES WERE SELECTED FOR THIS EXPERIMENT; AND ONLY LOWER CASE LETTERS WERE EMPLOYED. THE AVERAGES ARE COMPILED FROM 'INTERNAL' LETTERS ONLY, I. E., THE INITIAL LETTERS AND THE FINAL LETTERS OF THE GROUPS ARE NOT INCLUDED IN THESE AVERAGES

Bulfinch	Caslon	Century Exp.	Century O. S.	Cheltenham Wide	Cushing Monotone	Cushing O. S.	News Gothic	Scotch Roman
a 140	a 137	a 150	a 145	a 142	a 123	a 139	a 160	a 135
b 138	b 155	b 158	b 155	b 152	b 138	b 146	b 170	b 182
c 147	c 130	c 140	c 143	c 152	c 131	c 142	c 167	c 123
d 142	d 133	d 154	d 150	d 158	d 123	d 140	d 163	d 127
e 124	e 127	e 135	e 145	e 135	e 120	e 138	e 149	e 115
f 160	f 175	f 193	f 178	f 168	f 120	f 150	f 174	f 170
g 185	g 190	g 205	g 200	g 210	g 195	g 213	g 218	g 215
h 163	h 184	h 170	h 160	h 165	h 150	h 172	h 143	h 150
i 143	i 143	i 156	i 168	i 153	i 152	i 167	i 162	i 149
j 140	j 175	j 170	j 180	j 165	j 175	j 187	j 155	j 160
k 183	k 183	k 160	k 185	k 175	k 150	k 195	k 168	k 185
l 136	l 137	l 153	l 162	l 163	l 141	l 147	l 138	l 148
m 148	m 141	m 152	m 144	m 152	m 147	m 165	m 165	m 148
n 136	n 129	n 140	n 145	n 155	n 150	n 145	n 146	n 127
o 143	o 139	o 141	o 155	o 160	o 128	o 138	o 160	o 120
p 158	p 195	p 190	p 168	p 195	p 195	p 220	p 169	p 185
q 150	q 163	q 177	q 190	q 175	q 147	q 173	q 173	q 164
r 146	r 141	r 158	r 165	r 141	r 141	r 157	r 158	r 141
s 165	s 122	s 135	s 152	s 130	s 120	s 133	s 175	s 129
t 136	t 125	t 149	t 158	t 123	t 128	t 173	t 171	t 158
u 153	u 123	u 140	u 145	u 150	u 133	u 153	u 166	u 136
v 153	v 154	v 157	v 153	v 158	v 138	v 153	v 154	v 148
w 188	w 170	w 187	w 195	w 185	w 188	w 203	w 198	w 185
x 166	x 133	x 158	x 161	x 144	x 134	x 158	x 167	x 137
y 153	y 142	y 160	y 162	y 170	y 155	y 195	y 164	y 158
z 163	z 126	z 135	z 149	z 147	z 120	z 130	z 165	z 125
Aver. 150	149	159	162	159	144	163	166	151

z Cushing Mon. 143.3 | z Cushing No. 2 156.7 | z Cushing O. S. 157.5 | z Am. Typewr. 159.2 | z Caslon O. S. 162.5

TABLE XII. THE RELATIVE LEGIBILITY OF GROUPED LETTERS

THE LETTERS IN EACH HORIZONTAL LINE OF THIS TABLE ARE ARRANGED IN DESCENDING ORDER OF LEGIBILITY—THE VERTICAL COLUMN AT THE LEFT CONTAINING THE MOST LEGIBLE ALPHABET. THE DATA FROM WHICH THIS TABLE WAS COMPILED DID NOT INCLUDE THE INITIAL LETTERS NOR THE FINAL LETTERS OF THE GROUPS

a	a	a	a	a	a	a	a	a
b	b	b	b	b	b	b	b	b
c	c	c	c	c	c	c	c	c
d	d	d	d	d	d	d	d	d
e	e	e	e	e	e	e	e	e
f	f	f	f	f	f	f	f	f
g	g	g	g	g	g	g	g	g
h	h	h	h	h	h	h	h	h
i	i	i	i	i	i	i	i	i
j	j	j	j	j	j	j	j	j
k	k	k	k	k	k	k	k	k
l	l	l	l	l	l	l	l	l
m	m	m	m	m	m	m	m	m
n	n	n	n	n	n	n	n	n
o	o	o	o	o	o	o	o	o
p	p	p	p	p	p	p	p	p
q	q	q	q	q	q	q	q	q
r	r	r	r	r	r	r	r	r
s	s	s	s	s	s	s	s	s
t	t	t	t	t	t	t	t	t
u	u	u	u	u	u	u	u	u
v	v	v	v	v	v	v	v	v
w	w	w	w	w	w	w	w	w
x	x	x	x	x	x	x	x	x
y	y	y	y	y	y	y	y	y
z	z	z	z	z	z	z	z	z

different faces of type which were employed in the present investigation may be regarded as variants from the twenty-sixth or common letter-form, yet, as a matter of fact, such a simple mode of envisagement of our problem does not do justice to the complex conditions which are found to be present in such a problem as this. The factors of size, of geometrical figure, and of heaviness or lightness of the lines which constitute the figure also play a part; and these two latter factors are neither constant nor uniform in their operation, as the reader may infer from an examination of the faces which are illustrated in Tables I, II, III, V, VI, VII, VIII, IX, X, XI and XII.

It is true that all of the letters employed in the investigation were printed in ten-point size. But the type-founder's unit of measurement refers to the size of the block of metal upon whose base the letter is cast, and not to the size of the letter itself. It is, of course, true that the size of the block of metal sets a limit which the size of the letter cannot exceed; but the size of the letter may be, and usually is, less than the size of the block of metal which supports it and which determines the number of 'points' which shall technically describe the size of the letter. Indeed, it is not unusual to cast, say, an eight-point letter upon a ten-point body; and a much greater difference between size of letter and size of body is possible, although greater divergences are neither customary nor commendable.

Hence, the fact that all of our letters are technically described as being of ten-point size does not guarantee that they shall all be of uniform width, nor even of uniform height. There are certain letters, the w's and the m's, which must, in the very nature of the case, be wider than others, the i's and the l's; and even the widths of the m and the w may vary, from face to face, if only the draughtsmen who design them choose to have it so. Nor are the heights of ten-point letters necessarily constant and uniform. Moreover, the lines which constitute the letter-form are themselves subject to variation; they may be faint, they may be heavy, they may be bold, they may contain both hair-lines and heavy lines, or they may contain lines of only one width or thickness throughout. Hence, any discussion of our results must consider the possible operation of three factors which may have to do with the legibility of letters: letter-form, size of letter, width of lines of letter. And when we come to the discussion of the results obtained from groups of letters, we shall see that yet a fourth factor—the extent of white margin around the letter—plays an important rôle.

A survey of Tables I, II and III shows that, as a matter of fact, all three variables are represented in the letters which were employed. But if, for the moment, we ignore these details, and seek to determine which of these sixteen faces, as actually employed in the art of printing, is the most readily legible when presented singly, we find an exceedingly interesting state of affairs.

Confining our attention first to the upper case letters, we discover that the Jenson face has a considerable lead over all of its competitors. The letters of the Jenson face were read, on the average, at a distance of approximately 282 cm., while the average for the sixteen faces is *ca.* 254 cm. The least legible face is American Typewriter,—which, indeed, is much less legible than any other face of the sixteen. The other fourteen faces fall into three groups. The most legible group contains (besides Jenson) Bulfinch, Century Oldstyle, Clearface, Cheltenham Oldstyle, Della Robbia, Century Expanded, News Gothic; Caslon Oldstyle, Cushing Oldstyle, DeVinne No. 2 and Ronaldson constitute the second group; while Cushing Monotone and Cushing No. 2 come next in order, with American Typewriter standing in a class by itself, as the least legible face.

Jenson was much less successful in designing a legible lower case face; his lower case characters are indeed scarcely more legible than the median of the sixteen faces. News Gothic proved to be the most legible of the lower case faces; and Cushing No. 2 is the least legible face of this series. Here the sixteen faces fall naturally into three groups: *1.* News Gothic, Bulfinch, Clearface, Century Oldstyle, Century Expanded and Cheltenham Wide; *2.* Jenson, Della Robbia, Cushing Oldstyle, Ronaldson Oldstyle, Cheltenham Oldstyle, DeVinne No. 2, American Typewriter and Caslon Oldstyle; *3.* Cushing Monotone and Cushing No. 2. The difference between the least legible face and the most legible face is much less in the lower case letters than in the upper case letters,—twenty-one per cent. as compared with thirty per cent.

The briefest examination of the letters which were employed in our investigation is sufficient to show that they differ not only in their form, but also in their size, and in the thickness or heaviness of the lines which constitute them. In order to obtain a clearer insight into the relative significance of each of these variable factors as determinants of legibility, we made accurate measurements of the height and the width of certain lower case letters of each face, as well as of the breadth of the lines which go to make up the

letters. Our measurements were made by means of a microscope which was equipped with a micrometer scale. Three letters, m, o and z, were selected for measurement; and it is assumed that the average size of these three letters, chosen from any face, may be regarded as being typical or representative of the relative size of all of the letters of the complete alphabet of the face to which they belong. In order to make it possible to institute a comparison between the size and the "blackness" or "heaviness" of any face of type, on the one hand, and its degree of legibility, on the other,

TABLE XIII. ISOLATED LETTERS

SHOWING THE WIDTH AND THE HEIGHT OF LETTER, AND THE THICKNESS OF LINE, EMPLOYED IN THE VARIOUS FACES, AND THEIR RELATION TO LEGIBILITY.

	Wide	High	Thick	h×w	h×w×t	Average distance
1. News Gothic ...	1933	1982	333	3831	1277	236
2. Bulfinch	2033	1800	328	3659	1200	234
3. Clearface	1840	1750	333	3220	1073	230
4. Century O. S...	1944	1780	300	3460	1038	228
5. Century Exp...	1813	1766	300	3202	961	227
6. Cheltenham W..	1833	1420	317	2603	823	224
7. Jenson O. S....	1812	1560	317	2827	896	215
8. Della Robbia....	1757	1602	275	2815	774	214
9. Cushing O. S...	1553	1700	333	2640	880	213
10. Ronaldson O. S.	1613	1481	243	2389	580	209
11. Chelt. O. S....	1523	1440	316	2193	693	206
12. DeVinne No. 2..	1853	1510	450	2798	1259	205
13. Am. Typwr.....	1544	1820	200	2810	562	202
14. Caslon O. S....	1611	1420	292	2288	668	202
15. Cushing Mon...	1471	1464	220	2154	474	191
16. Cushing No. 2..	1493	1480	200	2210	442	186

the following table is appended. The first column contains the list of sixteen faces, arranged in order of legibility. The numbers in the second column indicate the average width, expressed in microns, of the m, o and z of the face whose name appears upon the same line in the first column; and the third column specifies the average height of the same three letters. The numbers in the fourth column indicate the thickness of the stem of the i of each face, also expressed in microns. Each number in the fifth column is obtained by multiplying the height of the letter by its width; each of these numbers may be assumed to represent the coefficient

of area of a typical letter of each face. The numbers in the sixth column are obtained by multiplying the number which represents the area-coefficient by the number which represents the breadth of the principal lines which constitute the letter; these numbers in the sixth column may, therefore, be regarded as area-breadth coefficients which represent the relative size of letter and breadth of line which appear in the several faces.[6] Now an examination of the numbers in the fifth column shows that there is, in the upper part of the column at least, an approximate correlation between size of letter and degree of legibility. And when "heaviness" of line is also taken into consideration, as is done in the sixth column, one finds that the correlation is even more striking, for the first eight faces of the list. The fact that degree of legibility is correlated, at least in this approximate fashion, with size of letter and breadth of line of letter, leads one to suspect that, in these eight faces at least, the size of the letters and the amount of ink imprinted upon the paper by the lines of the letter were the chief determinants of legibility; and that such variants of letter-form as were represented in these eight faces played no essential part in determining the legibility of the letters.

The less legible faces of the list do not show such a perfect correlation. The lack of correlation is most evident in the case of DeVinne No. 2, which apparently should stand near the head of the list if size of letter and breadth of inked lines were the chief determinants of legibility. But it will be noticed that this face contains by far the heaviest lines of the series; and its relative illegibility is probably due to the fact that the optimal width of line is here exceeded, and that, in consequence, the white spaces within the letters have been encroached upon in so great degree as to promote illegibility. It would appear that the optimal breadth of line for lower case letters of this size may be in the neighborhood of 275 to 333 microns. It seems to be evident from our table that, when the breadth is reduced much below 250, or is increased in the neighborhood of 450, ten-point letters become relatively illegible.

It is scarcely possible, from the data at hand, to make any definite general statement regarding the relative significance of the three factors in question. Javal and others have insisted

[6] The numbers in the fifth and the sixth columns are intended to represent relative magnitudes only. In order to facilitate comparison we have omitted several of the right-hand digits,—three from the numbers of the fifth column, six from the numbers of the sixth column.

that the width of the letter is of prime significance as a determinant of legibility. And the fact that Cheltenham Wide, lower case, is read at an average distance of two hundred and twenty-four centimeters, while Cheltenham Oldstyle, which differs from the former scarcely at all save in its lesser width, is read only at two hundred and six centimeters, seems to confirm Javal's statement. But our experiments have convinced us that width of letter is but one of several factors which contribute to legibility; and one could assert with quite as much justice that the breadth of the lines which constitute the letter is the essential determinant of legibility. This latter statement, however, is true, if at all, only within relatively narrow limits.

The results which appear in Tables V and VI are of interest in this connection. Our experimental material here consisted of alphabets which represented a series of modifications of a given face. Cheltenham Oldstyle may be regarded as our standard face; Cheltenham Bold, Cheltenham Bold-Condensed, Cheltenham Wide and Cheltenham Italic represent modifications of our standard letter-form in the directions of greater heaviness of face, lesser width of letter-form, greater width of letter-form, and inclined or italic letter-form.

A survey of these results reveals the fact that legibility is very much increased by increased heaviness of face. In the upper case letters the increase in heaviness or breadth of line amounted to approximately forty-seven per cent., and the increase in legibility amounted to twelve per cent.; while in the lower case letters the corresponding data are forty-seven and fourteen per cent. When the Cheltenham Bold face is condensed by about twenty-three per cent., as is illustrated in the letters which appear in the third column of Table VI, its increase of legibility is lost,—being reduced by twelve per cent. This finding indicates that whatever advantage might have been derivable from increased heaviness of face, as compared with Cheltenham Oldstyle, is neutralized by a disadvantage which is due to a narrowing of the internal spaces within the letters, and a consequent sacrifice of detail. When the letter-form is broadened by eighteen per cent., its legibility is increased by nine per cent. The Italic letter-form proves to be but slightly less legible than the Roman face. In both the upper case and the lower case letters, the bold face is the most legible member of the series of modifications.

The data which are presented in Table IV show the relative legibility of each letter of the alphabet, both upper case

and lower case, when presented as isolated letters. The numbers which appear in these columns represent the averages of the readings of the sixteen faces of each letter. The upper case letters are, of course, legible at a greater average distance from the observer than the lower case letters. But the average legibility of both cases varies between wide limits; and it is a significant fact that certain of the latter letters are more legible than many of the former. The progressive decrease of legibility from the upper limit to the lower limit is fairly regular and uniform throughout, in both cases, with the exception of m and s. Indeed, our results show that the lower case s is by far the least legible letter of either alphabet. The upper case S also stands at the foot of its class, but the relative inferiority is here much less than in the lower case letter.

Any movement which plans to improve the forms of the letters of the alphabet must properly begin with the letters which appear in the lower half of this table. And, indeed, it might well confine itself, at the outset at least, to the lower case letters, for the twofold reason that they are, in general, less legible than upper case letters and are therefore most in need of reformation, and that our reading has to do, in the main, with the recognition of words which are composed of lower case letters exclusively. It is not the purpose of this paper to recommend or even to suggest the procedure by means of which an increased legibility of printing types is to be attained. But it may, at least, be mentioned in passing that letters are made more legible by an increased heaviness of printing-face; and that defective letters may be made more legible by simply extending their width. Both of these innovations would meet with opposition, however, from those readers who demand aesthetic beauty and grace of form as well as legibility. But it seems possible that all demands could be met and all interests could be safe-guarded if only sufficient skill and ingenuity were devoted to the task.

B. GROUPED LETTERS

The object of this part of the investigation was to determine how and to what extent the legibility of letters is affected by the presence of adjacent letters. It was to be expected that the isolated letter should possess an advantage over the member of the letter-group in point of average distance at which reading is possible. Is the disadvantage which results from grouping equally great for each face? What is the relation between legibility and position (initial, final,

intermediate) within the group of letters? What light is thrown upon our problem by the number and the nature of the misreadings or confusions which are due to the grouping of letters?

Isolated letters are invariably read at a greater average distance than are those letters which occur in groups. Among our material were eight faces which had been employed in both of our series of experiments, *i. e.*, they had been presented singly in the earlier experiments,—grouped in the later experiments. It is therefore possible to make a direct comparison between the degrees of legibility which were revealed under these two conditions. (The Scotch Roman face can not be included in making this comparison, because it was employed only in the later series of experiments.) The average distance at which these eight faces were read in the earlier experiments was 232 cm.; in the later experiments, 157 cm. The varying degrees of legibility tend to be reduced to a common level as a result of grouping, *i. e.*, differences in the legibility of different faces tend now to disappear. While the legibility of the eight faces, presented as single letters, varied between the limits 191 cm. and 236 cm., they varied only between the limits 144 cm. and 166 cm. when presented in groups. And the general reduction of legibility was so great that the most legible face of grouped letters proved to be wholly undecipherable at a distance where the least legible face of isolated letters was clearly and unmistakably legible.

The gross results of the experiments with grouped letters are presented in Table XI. The average distances are tabulated in more significant form in Table XIII, which also contains a statement of the relation between decreased legibility and size-heaviness of face.

News Gothic is still the most legible face, and Cushing Monotone the least legible. Century Oldstyle, Century Expanded, Cheltenham Wide and Caslon also maintain the same positions in the series which they held when isolated letters were employed. But Cushing Oldstyle, which occupied the sixth position in the former series, now moves up to the second position; and Bulfinch drops from the second to the sixth position. Scotch Roman, the face which had not been tested in the first part of the investigation, stands seventh in descending order of legibility.

Cushing Oldstyle and Bulfinch are the only faces which show any decided loss or gain in relative legibility, when submitted to the group-test. But one is led to inquire why

even these two faces should fail to maintain the same degree of relative legibility when presented in groups which they established when presented as isolated letters.

A comparison of the amounts of reduction in legibility which the various faces suffered from being grouped reveals the fact that these amounts vary from twenty-three per cent. to thirty-seven per cent. It is inevitable that certain faces should be subject to a relatively great disadvantage as a result of being combined into groups, and from being printed "solid," as upon the body of an unleaded page. The letters of certain faces are so wide and so high that a comparatively narrow margin is left upon the block of metal which constitutes the body of the type, while in other faces the margin is relatively wide. For example, our measurements show that the Bulfinch m is 2560 microns in width and 1828 microns in height, while the corresponding measurements of the Cheltenham Oldstyle m are 1948 and 1440 microns. Variations in width of letter need not be considered here, because there need be no corresponding variations of width of blank space between adjoining letters upon the printed page. But the difference in height between the letters of these two faces is so great that adjacent lines of the two, if set "solid," would show an intervening space of white paper which would be 380 microns wider in the case of Cheltenham than in the case of Bulfinch. It follows then that while the ten-point letters of greatest average height are most legible when presented singly,—because they subtend a larger visual angle,—they tend to lose their advantage when combined into groups and lines,—because the lines are separated from one another by narrower intervening spaces of white; and the reader finds that the letters of adjoining lines tend to merge into one another.

The effect of breadth of interlinear space could be shown quantitatively by correlating the average height of each face with the relative amount of decrease in legibility which it suffers as a result of grouping. It would then be found that those faces whose average height is greatest have suffered most from being presented in groups, while those faces whose average height is least have suffered least. The correlation becomes more striking however when thickness of line as well as height of letter is taken into account. But even here, News Gothic and Cushing Old Style appear to be exceptions to the general rule.

Now it is a remarkable fact that these two types are by far the heaviest faces of the series. In selecting an arbitrary method of giving quantitative expression to the combined

influence of the factors of size of letter and of heaviness of line, in order that seriation and comparison might thereby be facilitated, we have chosen to multiply the height of the letter by the thickness of the line. It is evident, however, that these two factors are wholly different in their mode of operation and in their relation to legibility. The legibility of a face undoubtedly increases directly with the increase in the size of the face; and the ratio between the two is capable of simple quantitative expression. But the relation between legibility and heaviness of face is far from being a simple one. Beginning with the faintest monotone, legibility increases with increase of thickness of line until an optimal thickness of line, for a given size of letter, is reached; from that point onward legibility decreases with increase of thickness of line, because now the internal details of a, c, e, o, etc., are being narrowed down to mere points, and discrimination of detail soon ceases to be possible. We are not in possession of any data which furnish a basis for estimating the point at which the optimal thickness of line is reached, nor for estimating the relative significance of size of letter and thickness of line. And until such data are obtained it will remain impossible to seriate the numbers in the fifth column in any just or appropriate fashion.

Our results, however, indicate that the variations of letter-form which were present in our nine faces did not vary between sufficiently wide limits to have any considerable effect upon the relative legibility of our letters. Such differences of legibility as were revealed are, we believe, referable solely to variations in size of letter (and of interlinear space), and to variations in heaviness of face.

If legibility is to be our sole criterion of excellence of type-face, News Gothic must be regarded as our nearest approximation to an ideal face, in so far as the present investigation is able to decide this question. The aesthetic factor must always be taken into account, however, here as elsewhere. And the reader who prefers the appearance of Cushing Oldstyle or a Century face may gratify his aesthetic demands without any considerable sacrifice of legibility.

An examination of our records of the misreadings of letters throws an interesting light upon the question of similarities of letter-form, and upon the question of the criteria employed by the reader in deciphering letters. When the letters first appeared at or beyond the extreme limit of reading distance, the reader was usually conscious, from the outset, of a more or less definite *Einstellung*. If they were lower case letters,

and especially if they were presented in isolated form, the reader first set out upon a more or less definite search for the "broad" letters,—m and w. He seldom failed to discover these two letters in the earlier stages of the settings of the carriage, although he was seldom able to discriminate between m and w until the carriage had been brought nearer to his eye. His next endeavor was to find the "narrow" letters, —i, l, j; another category was "letters which are wider at the top than at the bottom,"—v, r; V, Y, T, F, P. Here again he almost invariably succeeded in referring the letter-form to its appropriate category some little time before he was able to distinguish its details and name it with any degree of certainty. Other general groups were "circular letters,"—o, e, c; O, C, G, Q; "square letters,"—H, K, E, B, D. Among the lower case letters, "ascenders" and "descenders" were almost invariably recognized as such, before their details became clear. While the reader was still struggling with one or other of these categories, the "unclassified" letter-form began to emerge in an order which can not well be formulated in a general statement.

This description of the reader's procedure indicates the type of confusion or misreading which proved to be most frequent. Letters which may be regarded as members of a common category were especially likely to be confused with one another; r, v; o, c, e; x, z; u, n; b, h, k; q, y; i, l, j, t, f; M, W; H, K, E, B, D; O, Q, C, G; V, Y F T; I J, L.

Several wholly new types of misreadings made their appearance when the letters were presented in groups. These may be described as 1. Combinations, 2. Separations, and 3. Elisions. 1. It frequently happened that adjoining letters were blended together by the reader, and that a single letter was constituted by this combination of parts, or wholes, of different letters, thus: lc (k); ls (k); lx (k); li (h); cl (d); cf (d); un (m); in (m); vr (w); js (p); vj (y); cj (q); hj (ly); bj (lq); chn (dm); ck (dx). 2. The separation of letters into their parts has been illustrated in the above group. It also ocurred in such cases as wm (vun); ld (bl); bj (lq); hj (ly); kd (hcl). 3. perhaps the most striking misreading was due to the complete elision of certain letters of the group. This phenomenon was especially common with such slender or narrow letters as i, j, t, r, v, s. When i or t was interpolated between ascending letters, when j occurred between descenders, and when r and s were present in any context of whatever sort, they were likely to be wholly overlooked. And it frequently happened in such cases that

the observer read and reread the group of letters, specifying correctly every letter which was present excepting these narrow letters. When the carriage had been brought so close to his eye that he finally detected their presence, he usually expressed surprise that these "indifferent" letters had escaped detection so long.

The position of the letter in the group—initial, final, intermediate—is an important factor in determining the legibility of the letter. When a group of letters first comes into view, it almost invariably happens that certain of the letters stand out more prominently than their neighbors. The part which these "dominating" letters play in our recognition of familiar words has been discussed at length by Zeitler, Messmer, and others, who have pointed out that the rôle of the "indifferent" letters in our recognition of familiar words is relatively insignificant. Pillsbury and others have shown that, all other conditions being equal, the initial letter or letters in the word are of most significance in the act of reading.

In compiling the results obtained from the reading of our letter-groups, we have made three distinct tables of data,—for the initial letters, for the final letters and for the intermediate letters of the groups. The letter results have already been presented, in Tables XI and XII. A comparison of these three series of average distances shows that the initial position constitutes an optimal condition of legibility; the final position comes next in order, and the intermediate position is least favorable,—the general averages being 196 cm., 185 cm., and 156 c., respectively.

It must, of course, be borne in mind that all intermediate positions are not equally disadvantageous, because the form of the adjacent letters is really an essential factor which aids or hinders legibility. For instance, an m which stands between u and n is much less legible than an m which stands between o and c; and the helpful or harmful influence of ascending and descending letters is also very great. The significance of the initial position or the final position is also subject to variation. It is evident, for instance, that those letters whose "loop" is upon the right,—b, h, p,—will derive more benefit from appearing in the final position than will those letters whose "loop" is upon the left,—d, q, Yet the superior advantage of the initial position is so great that b, h, and p frequently proved to be read at a greater distance when they appeared as initials than when they appeared as final letters, notwithstanding the fact that the characteristic parts of these letters appeared in close proximity to a

neighbor in the former case, while in the latter case they jutted out into the blank spaces between the groups.

Lower case c was read at the following average distances: Initial 155 cm., final 163 cm., intermediate 144 cm. The corresponding data for several other letters are: e, 140, 147, 123; o, 158, 153, 143; b, 187, 198, 155; d, 200, 165, 143; h, 185, 200, 162; k, 195, 198, 176; p, 201, 207, 186; q, 209, 194, 168; f, 196, 202, 176. The "symmetrical" letters show, in more accurate quantitative form, the relative advantages of the initial and the final positions; v, 185, 172, 152; o, 158, 153, 143; m, 163, 156, 151; w, 210, 199, 189.[7]

The Relation Between Legibility and Quality of Paper-Surface

As already indicated, our groups of letters were printed in duplicate upon a coated book-paper, and upon an antique laid book-paper. A comparison of the average distances at which the letters were read under these two conditions should throw light upon the general question as to the dependence of legibility upon the quality and texture of paper employed by the printer.

This question has been raised in various forms, in the history of the art of printing. Many years ago Babbage recommended the use of slightly yellowish paper for the manufacture of books; and indeed, he succeeded in persuading a publisher to produce a book of logarithms in accordance with this recommendation. More recently Javal has advocated a similar innovation, urging that such a plan would minimize the disadvantage to which the reader is subjected on account of the intensive contrast between the black ink and the white paper which are in general use.

It is impossible, from data available in the literature of this

[7] The reader is again warned that these data do not warrant a comparison as to the relative legibility of different letters of the alphabet. The writer does not guarantee that the juxtapositions of letters which occurred in our groups were equally disadvantageous for all of the letters of the groups. It is obviously an exceedingly difficult task to so arrange a series of groupings that all of the letters in the groups will be treated with even-handed justice in so far as advantageous and disadvantageous collocation with their neighbors is concerned. A juxtaposition which is relatively advantageous to l or h may be relatively disadvantageous to o or v. This condition we could not hope to fulfil; our aim was rather to treat all of the faces with equal fairness,— to present no combination of letters of one face which did not recur in the letters of every other face; our data therefore warrant a comparison of the relative legibility of the various faces, but not of the relative legibility of the various individual letters of the same or different faces.

and cognate topics, to determine whether this Babbage-Javal suggestion is really of value. But such results of the present investigation as have a bearing upon the question would seem to indicate that little or no improvement of legibility is to be expected from progress in this direction.

The results which we obtained in those experiments which consisted in presenting groups of letters of nine faces which had been printed upon coated white paper and rough-finished, very slightly yellowish paper, show a surprisingly slight difference of legibility in the two cases. The average distance at which the letters were read in the former case was 144.9 cm., and in the latter case, 145.0 cm. Altogether 234 letters were employed in these experiments, and 2,808 readings were taken. The experimental conditions were identical in the two cases, excepting the difference in the quality, the color and the texture of the paper upon which the letters were printed. Occasionally we found individual differences among our observers,—a greater efficiency when a particular face of type appeared upon the one or other of the papers; but in not a single instance does the individual difference in legibility amount to more than three per cent.; and in no instance did we find a unanimous preference of either paper with any face of type. Not only then are the individual variations so slight as to be negligible, but they are so irregular and inconstant as to be subsumable under no general principle. And the only conclusion which they warrant is that even such a considerable difference as was represented in our two papers has little or no significance for legibility.

V. CONCLUSIONS

1. Certain faces of type are much more legible than other faces; and certain letters of every face are much more legible than other letters of the same face.
2. These differences in legibility prove to be greater when letters are presented in isolation from one another than when they are presented in groups.
3. Legibility is a product of six factors: *1.* the form of the letter; *2.* the size of the letter; *3.* the heaviness of the face of the letter (the thickness of the lines which constitute the letter); *4.* the width of the white margin which surrounds the letter; *5.* the position of the letter in the letter-group; *6.* the shape and size of the adjacent letters. In our experiments, the first factor seemed to be less significant than any of the other five, *i.e.*, in the type-faces which were employed in the present investigation, the form of any given letter of the alphabet usually

varied between such narrow limits as to constitute a relatively insignificant factor in the determination of its legibility.

4. The relatively heavy-faced types prove to be more legible than the light-faced types. The optimal heaviness of face seems to lie in a mean between the bold faces and such light faces as Scotch Roman and Cushing Monotone.
5. The initial position in a group of letters is the most advantageous position for legibility; the final position comes next in order of advantage, and the intermediate or internal positions are least favorable for legibility.
6. The size and the form of the letters which stand adjacent to any given letter play an important rôle in determining its legibility; and the misreadings which occur in the case of grouped letters are of a wholly different sort from those which occur in the case of isolated letters. When letters of the same height or of similar form appear side by side, they become relatively illegible. But the juxtaposition of an ascender, a descender and a short letter tends to improve the legibility of each, as also does the juxtaposition of letters which are made up wholly or chiefly of straight lines and letters which are made up wholly or chiefly of curved lines.
7. The quality and the texture of the paper is a much less significant factor than has been supposed,—provided, of course, that the illumination and the inclination of the paper are such as to secure an optimal condition of light reflection from its surface.
8. There is an urgent need for modification of certain letters of the alphabet.

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THE PSYCHOLOGY OF THE NEW *BRITANNICA*

By E. B. Titchener

The psychological centre of the new *Britannica* is the comprehensive article by Professor Ward, which has now, we may suppose, taken on its final form. The article was first written for the ninth edition,[1] and appeared in 1886. It was written, therefore, at the age when, as its author reminds us, a man has already become 'a bundle of habits;' there was nothing tentative about it, no suggestion of the rough draught of a system; every topic had its appointed place, and every argument showed mature reflection. It was written also, Professor Ward tells me, under some pressure of time; and this circumstance had its good effect; the essay is *aus Einem Gusse gegossen*. Recognition came at once: the late Professor Bain, who had been warmly praised and soundly pummelled, replies in the same knightly fashion: "the thorough knowledge of previous works, the freshness of the handling, the never-failing acuteness, the light thrown upon many of the dark places of mental science,—constitute the work a signal achievement of philosophical ability."[2] And the influence of the 'Psychology' has steadily widened; one might, indeed, in a venturesome mood, bring it into comparison with Brentano's *Psychologie vom empirischen Standpunkte;* for the relation which Professor Ward sustains to current British associationism is not unlike that of Brentano to the Wundtian school in Germany.

A second article, prepared for the supplement which took the place of the tenth edition of the *Britannica*, appeared in 1902. The intervening years were notable in the history of psychology; they were years of rapid horizontal expansion, during which laboratories were equipped, journals were founded, and comparative psychology and mental pathology made unwonted progress. It may well be the case that psychology outgrew its strength, that a 'thorough scrutiny of methods' is needed before the new results 'can be safely or

[1] The author had already published *A General Analysis of Mind* (Journal of Speculative Philosophy, XVI. 1882, 366), *Objects and their Interaction* (*ibid.* XVII. 1883, 169), and the first two articles entitled *Psychological Principles* (Mind, O. S. VIII. 1883, 153, 465).

[2] *Mr. James Ward's "Psychology,"* Mind, O. S. XI. 1886, 457.

systematically incorporated into the science:' at any rate there is good material mixed with the bad, sound with the flimsy: and the superficial extension of psychology, the widespread adoption of the psychological attitude, is itself a sociological phenomenon of the first importance. Professor Ward is, however, less interested in these things than in the 'signs of life' shown by the 'old' psychology. He had himself discussed, in the *Naturalism and Agnosticism* of 1899, the great questions of the perception of an external world and of the relation of body and mind. He had also published in 1893-4[3] two articles on *Assimilation and Association*, in which Höffding's 'quality of familiarity' and 'tied ideas' were turned to account for a genetic study of ideation. James' apologetic paper on the 'Physical Basis of Emotion' came out in 1894; von Ehrenfels' *Gestaltqualitäten* appeared as 'forms of combination' in Stout's *Analytic Psychology* (1896). It is still the 'old' psychology, then, that the supplementary article expounds and advances; the sections on the Experimental Investigation of Memory and on Comparative Psychology are as nearly perfunctory as the writer's critical acumen and philosophical conscience will allow. And so we are not surprised —though many of us, no doubt, have been disappointed—to find that the revised article of 1911 is, in all essentials, simply a skilful blend of the articles of 1886 and 1902.

The supplementary article occupies 17 pages; the original article required 49. The article of 1911 occupies 58 of the slightly larger pages of the new *Britannica*.

The Introduction (§ 1, The Science of "Mind;" § 2, Standpoint of Psychology) is substantially the same as in the article of 1886. Here, as throughout,—the statement may be made once for all,—the author has revised with extreme care; everywhere there is weeding, pruning, dovetailing; but the substance of the two preliminary sections is unchanged. Under *General Analysis* we have first, in § 3, the discussion of Experience from the tenth edition: the paragraph on Pragmatism is omitted. Sections 4-8 then practically repeat the ninth edition; the fine-print discussions of the subjectivity of sensations, of the connection between subjective attention and objective intensity, and of the non-presentability of feeling and attention are, however, omitted. A new §9 is devoted to *Attention*.[4] The *Theory of Presentations* opens (§§ 10-12) with the familiar treatment of the Psychological Individual, the Presentation Continuum, and Retentiveness; an interpolated § 13 gives a brief note on Assimilation; and the discussion of Relativity follows (§14), thus changing places with that of Subconsciousness. Professor Ward has entirely rewritten this latter section, §15, and has raised it—if not, as Bain counselled, from brevier to pica, at least—from brevier to long primer: the core of

[3] Mind, N. S. II. 1893, 347; III. 1894, 509. The tenth and eleventh editions give the dates as 1894-5. The proof-reading of the latter edition is far from impeccable.

[4] Cf. *Psychological Principles*, III. Mind, O. S. XII. 1887, 45.

doctrine remains unchanged.[5] Section 16, *Sensation, Movement and the External World,* owes its change of title, its introduction, and its conclusion, to the tenth edition; the treatment of the characteristics of sensation is expanded from the ninth. *Perception* (§§ 17-20) and *Imagination or Ideation* (§§ 21, 22) stand with a few omissions—compensated, as most of the omissions of the article are, by later additions—as they stood before. A new § 23, on the *Genesis and Development of Ideation,* comes in from the tenth edition. Sections 24, 25, *Mental Association and the Memory-Continuum,* and §§ 26-29, *Reminiscence and Expectation: Temporal Perception,* repeat the ninth edition; a critical note is added on the relation of successive to simultaneous association, and on the notions of 'form' and 'law' of association. Then comes the excursus (from the tenth edition) on *Experimental Investigations concerning Memory and Association.* The sections on *Feeling* (§§ 31-33) are as they were. *Emotion and Emotional Expression,* from the tenth edition, follows as § 34; *Emotional and Conative Action,* § 35, stands unaltered. The treatment of *Intellection* and *Categories* is extended by the introduction of § 39, *Objects of Higher Order: their Analysis and Genesis,* from the tenth edition; otherwise there is practically no change in §§ 36-42. *Belief* is then given a separate heading, and raised to the dignity of long primer. The subject-matter of *Presentation of Self, Self-Consciousness and Conduct* (§§ 44-46) has been newly articulated, and the concluding note on Freedom has been rewritten. Section 47, *Relation of Body and Mind,* comes from the tenth edition, as does also the appendix, § 48, on *Comparative Psychology.* A revised list of *Authorities* brings the article to an end.

"Systematic psychology," Professor Ward has remarked, "is neither bulky nor liable to change every half-dozen years;" and again, "The concepts of general psychology are presupposed in the many special departments, . . . and will be presupposed in whatever new developments of the science the future may have in store." These statements may be taken as the text of his new 'Psychology.' From the point of view of systematic psychology, the only important additions are to be found in the introductory §§ 3, 9, 16 (Experience, Attention, Definition of Sensation), and in §§ 23, 39, which deal with assimilation and form of combination; and in these sections we have simply a clarification and direct extension of the doctrine of 1886. As for the remaining new matter,—while we are all grateful for anything that Professor Ward cares to write,—I cannot but think that from his own standpoint it is irrelevant, and that from the standpoint of the 'special department' it is incomplete. Let me quote, to begin with, a passage from the Editorial Introduction to this eleventh edition of the *Encyclopaedia.* "Those earlier contributions have been preserved," we read, "which are of the nature of classics in the world of letters. By a selective process, which, it is believed, gives new value to the old material

[5] Cf. *The Present Problems of General Psychology,* Philos. Review, XIII. 1904, 619.

—by the revision, at the hands of their own authors or of later authorities, of such articles or portions of articles as were found to fit accurately into their several places—or by *the inclusion under other headings of a consideration of controverted questions on which the writers may have taken a strong personal view, itself of historical interest*—their retention has been effected so as to conform to the ideal of making the work as a whole representative of the best thought of a later day."[6] Admirable!—but, so far as psychology goes, more honored in the breach than in the observance. Professor Ward takes a strong personal view of psychology, which has much more than an historical interest; all psychologists are his debtors for its expression. But he treats of Experimental Psychology in an excursus, and of Comparative Psychology in an appendix to his article; and the specialist looks in vain for the special articles *Experimental Psychology* and *Comparative Psychology*. Those students of psychology —and, rightly or wrongly, there are many of them—who care less for epistemological principles than for the actual *facies* of the science, will hardly agree that the Editor has fulfilled his promise. Again, even if an enlightened view of the Relation of Body and Mind 'makes psychological revision inevitable,' still the topic itself belongs, on Professor Ward's own showing, to Psychophysics,—of which more in a moment; while he would be the last to deny either that the issues in this problem are controverted or that his handling of it is strongly personal.[7] There remains the discussion of the James-Lange theory of emotion (§ 34). This, if retained in full, should have been incorporated in a special article *Emotion:* there is, by the way, no such article: as it stands, it interrupts the general argument; the reader is jerked to an unfamiliar standpoint.

I turn back once more to the Editorial Introduction,—to the section that deals with formal arrangement. "Under the name of the common subject of the science as a whole,[8]

[6] Cf. I. xiv. The italics are mine.

[7] Readers of Professor Ward's recent writings will remember his insistence on the distinction between 'psychological' and 'psychophysical,' and on the priority of general psychology to 'physiological psychology.' Yet in the new article 'Psychology' (p. 583), as in the old (p. 69), it is 'on the whole a satisfactory explanation' of the pleasurableness and painfulness of combinations of colors that "the one arrangement secures and the other prevents perfect retinal activity!"

[8] Will it be objected that psychology is not a 'science'? But Professor Ward gives as its formal definition 'the science of mind;' and the Editorial Introduction makes but one, quite casual, reference to Philosophy. See also Note 12 below.

its history and general aspects are discussed, but the details concerned with the separate scientific questions which fall within its subject-matter . . . are relegated to distinct articles, to the headings of which the general account becomes, if required, a key or pointer. This arrangement of the scientific material—a general article acting as pointer to subsidiary articles, and the latter relieving the general account of details which would overload it—has been adopted throughout the Eleventh Edition; and in the result it is believed that a more complete and at the same time more authoritative survey has been attained, within the limits possible to such a work, than ever before." [9] In other words, the present edition follows the 'dictionary plan,' whereas the ninth edition followed the 'single-treatise plan' of an Encyclopaedia. We shall, therefore, expect to find three groups of subsidiary articles: (1) those which cover the 'special departments' of psychology,—experimental psychology, psychology of the abnormal, and so forth; (2) topical articles, corresponding to the chapter-heads of a systematic psychology (sensation, attention, association) and to the more important subdivisions of lines of departmental knowledge (hypnotism, psychology of adolescence); and (3) biographical articles. Let us see what, under these three headings, the twenty-eight volumes have to offer.

(1) I have said that there is no article *Experimental Psychology;* neither is there a *Physiological Psychology. Psychophysics*—which in the ninth edition curtly enjoins the reader to 'see Weber's Law'—now heads an article; but the article has only 20 lines (about half as many as are assigned to *Teacaddy*); it opens with a false etymology, mentions a few leading names, and ends with a random string of instruments and fields of investigation. This treatment (or lack of treatment) is the more regrettable, since many of the topical articles refer in somewhat sweeping terms to 'modern physiological psychology' and to 'psychophysical researches.'[10] I have said, again, that there is no article *Comparative Psychology;* neither are there articles *Class Psychology, Collective Psychology, Ethnic Psychology, Genetic Psychology, Individual* or *Differential Psychology, Psychopathology, Social Psychology.* The seeker after knowledge must go either to the topical articles (the range of which will appear in what follows), or to articles written from the standpoint of anthropology, ethnology, phil-

[9] Cf. I. xviii.

[10] So, e. g., *Affection, Association of Ideas, Attention, Extension, Introspection,* etc. Other articles, in which we might expect an experimental reference are silent in the matter: so *Cold, Perception, Rhythm, Space and Time,* etc.

osophy, sociology—of some discipline that is emphatically not psychology, however closely 'related' to it in a classification of the sciences.[11] Psychology, indeed, seems to have shown but faintly above the editorial horizon; the fundamental articles on *Evolution* and *Science* ignore it.[12] There is no attempt at a *History of Psychology*, though both Ethics and Logic receive historical treatment.

There is no article *Applied Psychology;* and there are no articles *Educational Psychology, Juristic Psychology* (psychology of testimony, case analysis), *Psychotherapeutics.* There is an elaborate article *Phrenology*[13] (A. M.);[14] and the expression of emotion is treated under *Physiognomy* (A. M.).

It is obviously far more difficult to say what an Encyclopaedia contains than to point out what titles it omits. And the difficulty is increased, in the present instance, by the lack of an Index. I understand that the forthcoming Index Volume will supply a full page-index of names and subjects. This will doubtless convict me of many mistakes: I do not think, however, that it will make the following notes superfluous.

Psychotherapeutics.—There is nothing to the point in the articles *Medicine* and *Therapeutics.* The article *Hysteria* (J. B. T.; E. B.) says nothing of psychoanalysis. *Christian Science* mentions the recent development of psychotherapy; and *Faith Healing* (N. W. T.) refers all forms of mind-cure (on which there is no article) to suggestion. The articles on *Hypnotism* and *Suggestion* will occupy us later.

Juristic Psychology.—The articles *Attestation, Evidence, Oath* and *Witness* make no psychological reference. The article *Criminology* (A. G.) refers briefly to the psychology of the criminal.

Educational Psychology.—The article *Child* remarks: "Into the psychological characteristics and development of the child and all the interesting educational problems involved it is impossible to enter here;" the writer accordingly contents himself with a list of books and a word of general caution. The article *Education* (J. We.) makes a bare reference to the psychological differences between Froebel and Herbart. *Habit* is merely defined; *Fatigue* does not appear. I have found nothing on the subject of *Mental Tests.* The article *Interest* is not psychological. Nor—to pass to another department of applied psychology—is the article *Advertisement.*

[11] The article *Classification* makes mention of a 'Carl Wundt,' whom I take to be a portmanteau-person, compounded of Carl Stumpf and Wilhelm Wundt.

[12] On the other hand, the article *Philosophy* accepts the "definitive establishment of psychology as an independent science," in order to mark it off sharply from epistemology.

[13] The subject is also discussed under *Brain.* Several articles upon anatomical and physiological subjects (lists are given under *Anatomy* and *Physiology*), as well as the article *Neuropathology,* are of interest to psychologists.

[14] The initials given here and in later references to psychological articles are those of the authors; the names will be found in the Appendix to this review. Many articles are unsigned.

Genetic Psychology next suggests itself. *Adolescence* is treated from the standpoints of hygiene and education: *Children's Games, Infancy, Infant,* are not psychological articles; *Play* tantalises us by a reference back to *Child.* We may add here a mention of the brief discussion of *Imitation,*[15] which in turn leads us to the topic of *Instinct* (C. L. M.) This is made a matter exclusively of animal psychology; at least, there is no account of human instincts. The author of the articles writes also upon *Intelligence in Animals.*[16]

Social and *Ethnic Psychology* are almost wholly merged in Anthropology, with the result that ethnic psychology has the better of the bargain. There are brief remarks on psychology at the beginning and end of the article *Sociology* (B. K.). There is no psychological discussion of *Custom.* The first part of the article *Philology* ('The Science of Language in General;' W. D. W.) is largely psychological. The article *Religion* (J. E. C.; R. R. M.) declares that the origin of religion must be sought conjecturally through psychology, and has a section entitled 'Psychology of the Primitive Attitude towards the Sacred': otherwise there is no explicit discussion of the religious consciousness. The article *Conversion* does not supply this deficiency. *Animism* (N. W. T.) has a section upon the origin of religion; and a long series of related articles—beginning with *Anthropology* (E. B. T.) itself—contain materials for ethnic psychology. I have probably not noted them all; I mention *Costume, Death, Divination, Family, Fetishism, Folklore, Funeral Rites, Image Worship, Magic, Mythology, Prayer, Ritual, Sacrifice, Salutations, Totemism.* These articles are for the most part of a high order of merit; the psychologist can only regret that the psychological aspect of their subject-matter does not receive greater emphasis, and that they are not more closely articulated with *Psychology.* The article *Aesthetics* (J. S.) is written by a psychologist and from the psychological point of view; and a good deal is said of the psychology of art, social as well as ethnic, in the article *Fine Arts* (S. C.). *Humour* is not treated psychologically; *Wit* has no article.

Collective Psychology finds incidental mention in the articles *Economics, Imitation, Religion* and *Suggestion. Differential Psychology,* whether of the class or of the individual, has been strangely neglected; in particular, there seems to be no discussion anywhere of the psychology of sex; the article *Sex* is purely biological, the article *Prostitution* (save for its brief introduction) purely sociological. *Visualisation* does not appear; and the articles *Galton, Image, Imagination* are silent regarding it.

There remain *Psychology of the Abnormal* and *Psychopathology.* The article *Dream* (N. W. T.) is of a general, somewhat popular sort; no attempt has been made to correlate it with *Psychology,* and Freud is mentioned only in the bibliography. *Hypnotism* (W. McD.) is treated sympathetically and at length. I should demur to the statement: "As a method of psychological investigation hypnotism has proved . . . capable of throwing much light on the con-

[15] Imitation is also discussed under *Fine Arts* and *Philology;* Play under *Aesthetics* and *Fine Arts.*

[16] The article *Heredity* is biological; the word 'psychological' occurs only in a list of transmitted characters. *Mendelism* and *Variation and Selection* are also biological. The latter article speaks of biometrics and of correlation, which have no special articles. For methods of calculating correlation we are referred to an *Error, Law of,* which is not included in the eleventh edition. We are also referred to *Probability* (F. Y. E.), which contains a great deal that is of value to the psychologist. *Statistics* is of psychological interest only as it deals with certain elementary points of method.

stitution of the mind, has opened up a number of problems of the deepest interest, and has done more than any other of the many branches of modern psychology to show the limitations and comparative barrenness of the old psychology that relied on introspection alone and figured as a department of general philosophy." The last clause, at any rate, exalts unduly the importance of the hypnotic method and underrates the value of pre-experimental psychology. The section on Theory strikes me as inadequate: as does also, from the psychological side, the same writer's article *Suggestion*. He gives a very full account of *Hallucination*.—The article *Dissociation* is not psychological. The article *Sleep* (J. G. M.) is reprinted without change from the ninth edition: one is glad to read again the classical description of the onset of sleep. The unsigned article *Somnambulism* is by the same author, reprinted from the earlier article *Sleep*. The brief articles *Catalepsy* and *Ecstasy* repeat, with some omissions, the previous articles of the same title; *Fascination* is new.

The article *Aphasia* (J. B. T.) has been rewritten, and gives a sufficient introduction to the subject, which is also discussed under *Brain*. *Medicine* makes a brief reference to morbid psychology. The articles *Hysteria*, *Insanity*[17] (J. B. T.; J. M.; L. C. B.), etc., are conceived, very naturally, from the standpoint of the psychiatrist rather than from that of the psychologist. There is, of course, psychology in them; but it is not worth while to consider them here in detail.

On the other hand, this is perhaps as good a place as any in which to call attention to the articles—many of them long and elaborate—devoted to *Psychical Research* (A. L.). I have noted *Apparitions* (A. L.), *Automatic Writing* (F. P.), *Clairvoyance* (N. W. T.), *Crystal Gazing* (A. L.), *Hauntings* (A. L.), *Medium* (N. W. T.), *Poltergeist* (A. L.), *Premonition* (F. P.), *Retrocognition* (F. P.), *Second Sight* (A. L.), *Spiritualism* (E. M. S.), *Subliminal Self* (W. McD.)—an article devoted wholly to Myers, *Telepathy* (N. W. T.). Psychical Research also figures, more or less largely, in the articles *Automatism* (N. W. T.), *Divination*, *Dream*, *Hallucination*, *Hypnotism*, *Possession* (N. W. T.), *Trance* (W. McD.). Would that the British Psychological Society had urged its claims upon encyclopaedic space as effectively as the Society for Psychical Research!

Are there not, however, other general articles, subsidiary to the 'key' article *Psychology?* There is an article *Naturalism* (J. W.), which deals in part with psychological theory; it is brief, polemical, and enjoins us to 'See also *Psychology*.' There is an unsigned three-sentence article *Parallelism, Psychophysical:* it ends, 'See *Psychology*.' There is a short unsigned article *Presentationism*, mainly concerned with Professor Ward's views: 'See especially the article *Psychology*.' There is a still shorter note on *Sensationalism:*

[17] In the course of correspondence regarding the eleventh edition, Dr. L. N. Wilson called my attention to the fact that Vol. XIV. of the set in the Clark Library repeats the Insanity statistics of the ninth edition, although the date assigned is 1901. I find, by personal examination and by further correspondence, that some sets have the correct, others the incorrect figures. (On p. 600 the Total of the first line of the table should be 48,882; if it is 29,452 the statistics of 1871 have been repeated.) Plainly, the plates have been changed since the Encyclopaedia was issued. I have made inquiry at the New York office of the Cambridge University Press, but have so far received no reply.

'See *Psychology.*' The reader may turn also, as he is directed, to *Empiricism* and *Phenomenon:* he will find cold comfort. There is no article *Interaction.*

There is an article *Matter,* but there is no article *Mind,* although a critical and historical account of what is, by the definition of the 'key' article, the subject-matter of psychology would have been most welcome. There is an article *Life,* but no article *Consciousness,* although again a critical and historical essay on "the vaguest, most protean and most treacherous of psychological terms" would surely have been in place. I find no articles *Experience, Explanation,* though these are suggested by the contents of the central article. *Causation* is too broadly treated to serve psychological purposes; and the note on *Teleology* does not refer to psychology at all.

There is no article on *Scientific Method.* The brief note on *Introspection* is certainly inadequate; it is also, I think, misleading.

There are no articles *Experiment, Laboratory.* I have found hardly anything upon psychological apparatus: I recall only the article *Stereoscope* (C. P.),[18] and the cut of Sieveking's aesthesiometer under *Touch.* A page of specifically psychological instruments would not, however, have been space wasted. No reference is made to *Scientific Congresses.* The article *Periodicals* does not mention, under the heading United States, any psychological journal.

(2) I have already trespassed somewhat upon this second division, of topical articles. Coming now to the main body of such articles, I note first a short article *Faculty.*[19] There are no articles *Mental Process, Psychosis.*

Sensation does not receive collective treatment. The six main articles, *Vision, Hearing, Touch, Taste, Smell* and *Equilibrium* are contributed by Professor J. G. McKendrick. One could not expect the veteran physiologist to plough afresh the immensely extended field of sense-psychology; neither could one desire to see the articles of the new edition taken altogether out of his hands. It is, however, a thousand pities that his work was not gone over by an experimental psychologist of the younger generation. The articles *Vision* and *Hearing,* in particular, are a lamentable blot upon the scholarship of the Encyclopaedia.

[18] This article itself (which bears somewhat too obvious marks of translation from the German) is written from the physical point of view, though it includes psychological discussion. Other physical articles (*Chronograph, Photometry,* etc.) may be useful to the psychologist. The article *Phonograph* figures a number of vowel curves.

[19] Mental faculties are also discussed under *Brain.*

In dealing with the departmental articles I have not referred to the tenth edition. It is now necessary to say that the six main articles on sensation are, like the central article *Psychology*, reproduced in essentials from the ninth and tenth editions together. I have no objection whatever to the inclusion of the older results; it is well to be reminded of things that, in the hurry of current research, one is too ready to forget. But the blend of old and new, in these articles, leads too often to muddle, even to contradiction. Here are two statements from *Smell:* (1) "If the two nostrils are filled with different odorous substances there is no mixture of the odors, but we smell sometimes the one and sometimes the other;" (2) "If, by means of a tube, an odor is conveyed into one nostril, while an odor of a different kind is directed into the other, there may be either a compound sensational effect, a sort of double-odor, or one odor may so predominate as entirely to destroy the other. The fusion of odors is not complete, and it is similar to the effect of combining, say, blue and red, in stereoscopic vision." The first of these statements, from Valentin, occurs in the ninth edition; the second appears in the tenth. If, now, we are curious enough to turn to the treatment of binocular color-mixture under *Vision*, we find this: (3) "Blue light may be admitted by the one eye-piece and red by the other; and on the convergence of the two, a resultant color, purple, will be observed. This may be termed the binocular vision of colors. It is remarkable that by a mental effort this sensation of a compound color may be decomposed into its constituents, so that one eye will again see blue and the other red" (from the ninth edition). Comment seems unnecessary.

Turn to *Taste.* (1) "Careful observations have shown that taste is only experienced when the sapid substance is allowed to come into contact with the taste-body, and that the sense is absent or much weakened in those areas of mucous membrane where these [*sic*] are deficient;" (2) "Further experiments with capillary tubes show that fungiform papillae destitute of taste buds, and areas of the surface of the tongue having neither papillae nor taste buds, may still, when stimulated by sapid substances, give rise to tastes:" the ninth and tenth editions again refuse to blend. Once more: (1) "Rapidly interrupted induced currents, which produce little or no electrolysis, may also excite taste" (tenth); (2) "The action of the interrupted current on the terminal organ is analogous to the action of sweet or bitter substances" (tenth): (3) "Rapidly interrupted currents fail to excite the sense" (from Grünhagen, in ninth). The three statements last quoted appear on the same page.

Turn to *Touch.* (1) "Pain is not a sensation excited by irritating the end organs either of touch or of temperature, nor even by irritating directly the filaments of a sensory nerve" (tenth); (2) "This sensation [pain] cannot be supposed to be excited by irritations of the end organs of touch, or of specific thermal end organs (if there be such), but rather to [*sic*] irritation of ordinary sensory nerves" (ninth).—I cannot devote more space to these articles. The essay on *Equilibrium* (new in the tenth edition) is fairly satisfactory;[20]

[20] One passage, at any rate, calls for comment. "A bird, on the other hand [as compared with the human acrobat], depends largely on visual impressions, and it knows by experience that if launched into the air from a height it can fly. Here, probably, is an explanation of the large size of the eyes of birds." (1) The fact that the bird's eye is relatively larger than our own, or than that of mammals generally, might depend upon the difference of type between the structures; the avian eye cannot be thus directly equated to the mammalian. (2) Are the eyes of birds—

the articles *Smell, Taste, Touch* are unsatisfactory; *Touch,* especially, is confusedly written.

I have to justify, so far as space permits, my criticism of *Hearing:* here, then, are a few points. (1) The *tensor* is credited with a twofold function: it serves as mechanism of accommodation to pitch and it acts as a safety-appliance for intensity. Thus are rival theories reconciled,—though how the muscle discharges its double duty we are, of course, not told. I need not say that recent work has put the accommodation-theory out of court. (2) The vestibular organs are "organs connected with the perception of sounds as sounds, without reference to pitch or quality." "These structures, however, are concerned rather in the sense of the perception of equilibrium than of sound." (3) The *DL* of pitch is given as "one sixty-fourth of a semitone," and again as "one-thousandth of the total number of vibrations,"—without any reference to pitch-number. (4) "When we listen to beats of considerable intensity, produced by two adjacent tones of sufficiently high pitch, the ear may follow as many as 132 intermissions per second." "Beyond 132 per second, the individual impulses are blended into one uniform auditory sensation." There is, however, a region of roughness or harshness, between sheer intermission and uniform blending; and Helmholtz' limit of 132 has been revised by later observers. (5) R. König's experiments with high forks are said to have 'settled the question' of beat tones: that is, the work of Schaefer and Abraham (1901) is ignored. (6) Consonance and dissonance are explained by Helmholtz' theory of beats, Stumpf is not mentioned in the article. The usual confusion of the two editions shows in the sentence: "Hitherto we have considered only the audition of a single sound, but it is possible also to have simultaneous auditive sensations, as in musical harmony:" two sections earlier there is a discussion of Dissonance (concords and discords).[21] (7) The following statement is amazing. "It is possible by means of beats to measure the sensitiveness of the ear by determining the smallest difference in pitch that may give rise to a beat. In no part of the scale can a difference smaller than 0.2 vibration per second be distinguished. The sensitiveness varies with pitch. Thus at 120 vibs. per second, 0.4 vib. per second, at 500 about 0.3 vib. per second, and at 1000, 0.5 vib. per second can be distinguished. This is a remarkable illustration of the sensitiveness of the ear." It is, unless I have read the sentences wrongheadedly, a remarkable illustration of misunderstanding

that is, of course, the eyeballs—relatively larger than those of mammals? In many cases, obviously; but I doubt the generalisation. There is also a patent difference in size between the eyes of nocturnal and of diurnal birds. (3) The 'here' of the last sentence is equivocal; it seems, however, to refer to both of the preceding clauses, to dependence on visual impression and to knowledge of ability to fly. But birds learn to fly, though they may learn quickly; and can we say, in any proper sense, that the adult bird 'knows' that it can fly? (4) Do dependence on visual impressions and empirical knowledge of power of flight 'explain' the size of the visual organ? It would seem rather that structure and function of the organs of flight, and structure and function of the organs of vision, are all determined interdependently by conditions which it is the business of the biologist to ascertain in detail.

[21] In the article *Voice* (J. G. M.) there is a new section, entitled "Vowel Tones." The author is concerned with the alternative of relative *vs.* fixed pitch of the characteristic partials, and decides by a compromise. This preoccupation forbids any clear statement of the Hermann-Pipping controversy: not, indeed, that the author is unique in that regard, for a sort of fatality of confusion seems to attach to the topic. But, at all events, the reader of the article will get no notion of the difference between the fixed-pitch theories of Helmholtz and Hermann; he may even be led to suppose that Fourier analysis reveals inharmonic partials.

on the part of the author. I take him to say that the *DL* in question are obtained from simultaneously sounding tones, and that they represent the differences of pitch-number at which a beat first becomes audible. To distinguish 1 beat in 5 seconds, even 1 beat in 2 seconds, thus testifies to the ear's sensitivity: and yet we know that the ear can recognize 1 beat in three minutes! This precious bit of tonal psychology has been taken over, uncorrected, from the tenth edition.

It is, I think, needless to go further; if these things lie on the surface, we shall not be likely to find improvement by digging deeper into the article. I therefore pass to *Vision*. (1) There is, first, a blunder in the interpretation of Newton's color-triangle; the ordinates of points within the triangle are taken, not as levers with masses attached, but as representations of amounts of color. (2) The negative after-image is ascribed, roundly, to fatigue. We are, therefore, ready for the statement: "The Young-Helmholtz theory explains the appearance of the consecutive colored images." We are not prepared for the later statement: "Hering's theory accounts satisfactorily for the formation of colored after-images." In point of fact, Hering's theory is incompatible with the doctrine of fatigue; and the negative after-image is precisely one of the facts of vision that Helmholtz fails to explain. (3) "The yellow spot in the centre of the retina is the most sensitive to light . . . Towards the anterior margin of the retina sensitiveness to light becomes diminished." These statements may be taken as true for light adaptation, though it is to be remembered that accurate observations have been made only with colored lights. The statements are, on the other hand, patently untrue as regards dark adaptation. The phenomena of adaptation are not mentioned in the article.[22] (3) "An impression lasts on the retina from 1/50 to 1/30 of a second." If a general statement is permissible, it would be more nearly true to say 1/70 to 1/10 of a second. (4) "Red appears to a red-blind person as a dark green or greenish yellow, yellow and orange as dirty green:" it is odd to read such a statement in the year of grace 1911! (5) "Aubert has stated that the minimum intensity [of light required to excite the retina] is about 300 times less than that of the full moon." He has: but later observers have pointed out that he considerably underestimated the intensity of moonlight; and his determinations have, at the best, no general validity. (6) A diagram is offered for the study of the blind spot, and the reader is instructed to "move the book towards and away from the eye." The dimensions of the diagram are such that, as a rough calculation shows, the 'round spot' disappears at a distance of some four inches from the eye. "The blind spot . . . is sufficiently large to cause a human figure to disappear at a distance of two metres." Helmholtz said *face*. (7) Hering's explanation of contrast is not mentioned; the references are to Helmholtz and Plateau. (8) Nothing is said of the functions of the rods, of twilight vision, of the *Duplizitatstheorie*. (9) The theory of visual space perception differs from that given in the central article (to which no reference is made); the treatment of illusion is meagre (there is no article *Illusion*); the brief note on apparent solidity does not refer to the article *Stereoscope*. For that matter, no one of these six articles is provided with a bibliography.

[22] The special articles treat *Adaptation* from the literary and biological points of view, and *Accommodation* only as a theological term.

There is, in the article *Vision*, a cross-reference to *Color* (J. R. C.). And the reader is plunged at once into a pleasing confusion. "Every color," says J. G. M., "has three qualities: (1) *hue* or tint, such as red, green, violet; (2) *degree of saturation*, or purity, according to the amount of white mixed with the tint, as when we recognise a red or green as pale or deep; and (3) *intensity*, or luminosity, or brightness, as when we designate the tint of a red rose as dark or bright." "Colors," says J. R. C., "differ in three respects, which Maxwell calls *hue, shade,* and *tint.* All hues can be produced by combining every pair of primaries in every proportion. The addition of white alters the tint without affecting the hue. If the color be darkened by adding black or by diminishing the illumination, a variation in shade is produced." Physiologist and physicist are thus perplexingly at odds; and neither has troubled to consult the psychologist. The article *Color* remarks, further: "Helmholtz has shown that the only pair of simple spectral colors capable of compounding to white are a greenish-yellow and a blue." When, and where? Helmholtz' complete table has persisted through the three editions of the *Optik*, and is reproduced by J. G. M. under *Vision!*

There are no articles *Kinaesthetic Sensation, Organic Sensation;* and the article *Joints* recognises articular sensation only in cases or injury or disease. *Muscular Sense* has a fine-print paragraph under *Touch.* We find a short, colorless article *Hunger and Thirst,* and a special article *Pain,*—although pain has been discussed twice over under *Touch.* There, however, nothing is said of pain spots; and, indeed, the article *Pain* agrees as little with J. G. M. as he, at his different dates, agrees with himself.——

It is, by the way, unfortunate that the cross-references in the psychological articles have not been more carefully scrutinised. Thus, the article *Pain* refers us to *Psychology, Aesthetics, Nervous System, Sympathetic System.* The reference to *Psychology* is correct: we read there of pleasure-pain, of organic pains, of cutaneous pain spots. But nothing about pain will be found under *Aesthetics* (except the passing statement that aesthetic enjoyment is free from certain 'painful elements'); nothing under *Nervous System;* nothing under *Sympathetic System.* The proper references are to *Affection* and *Touch,* neither of which is mentioned: *Brain* might have been added. The article *Attention* refers us to *Psychology, Brain:* but the latter article is discreetly silent on the subject[23] Many similar instances might be brought forward. On the other hand, there are cases in which a systematic use of cross-references by the editorial staff would have shown omission or divergence in the handling of a topic. The article *Recept,* which gives Romanes' definition of the term, does not refer to other articles. We turn, naturally, to *Intelligence in Animals;* but in that we find nothing save percept and concept. And if we then turn to *Psychology* (p. 561), we find a suggested meaning of reception and recept that ignores both Romanes and the *Recept* article.——

Turning now from quality to intensity of sensation, we find under *Threshold* a bare definition of the intensive stimulus-limen: there are no cross-references. The article *Weber's Law* (A. S. P.-P.) is practically unchanged from the ninth edition. Weber is credited with researches into aural sensations; right and wrong cases still figures as "the method of correct and incorrect instances;" in taste

[23] The word 'attention' occurs, it is true, in the account of certain experiments upon the auditory region of the cortex in dogs; but that is all; no attempt is made to determine the 'cortical substrate' or 'mechanism' of attention.

and smell, experiments are still "almost impossible." The author tells us to see *Psychophysics:* which we gladly do: but what is there under *Psychophysics* to see? The article *Extension* is fuller than is usual with articles of its class; but it, like the rest, falls back on the central *Psychology.* There is no article *Duration* or *Protensity.*

After sensation, *Affection.*[24] The affective element is recognised as co-ordinate with the sensory. The reference to Wundt's theory is misleading, since on that theory a sensation has always more than one specific affective quality; however, the writer does not repeat the mistake of the *Psychology,* and credit Wundt with the view that affection is a 'property' of sensation. The method of expression is inadequately handled. Fechner is not the writer of a 'modern text-book of psychology.'—There are no articles *Feeling, Emotion, Expression;* the expression of emotion is, as I have said, discussed under *Physiognomy. Mood, Passion,* are just defined; *Pleasure* refers us to *Psychology,* and not to *Aesthetics, Affection. Laughter* is not a psychological article.

A brief systematic article *Attention* is based on that of the ninth edition; it refers us to *Psychology.* There is not a word of description of experimental work. A new article *Apperception* notes briefly the use of the term by Leibniz, Kant, Herbart, and refers to *Attention, Psychology.* The reader of the article *Psychology* must be content, so far as this topic is concerned, to go away hungry: the reference itself is aggravatingly characteristic: for these secondary articles, instead of furnishing the details that the 'key' article omits, constantly fall back upon that article for further details. The new article *Conation* makes pleasure-pain a matter of sensation, referring to the experiences as 'hedonic sensations.' There is a false etymology of algedonics,—repeated, by the way, and with an additional Greek misspelling, in *Pain. Brentano* is called a 'German psychologist,' and is made the author of a *Psychologie:* would that he were! The cross-references are *Attention, Psychology;* not *Effort,* for there is no such article; and not *Will,* although there is a long essay with that title.

The short article *Perception* is historical, and bids us see *Psychology.* The special departments of perception fare badly. *Harmony* is written from the musical standpoint; the fusion of pure tones is not considered. *Rhythm* has nothing on perception. I have referred above to the lack of an article *Illusion.* The article *Space and Time* is not psychological. Formally, the perceptions of the various senses (as well as the sensations) are treated in the articles *Vision, Hearing,* etc.; the treatment is, however, far from adequate. The article

[24] I make no further reference to the tenth edition.

Cinematograph says nothing of theory: all that we have is the remark, under *Vision*, that "The cinematograph owes its effects to persistence of retinal impressions." The articles *Form, Fusion* are not psychological.

A new article *Abstraction* is of a general character; a new article *Apprehension* is better, but still not nearly full enough. There is no article *Assimilation*, in spite of the large place which this process occupies in Professor Ward's psychology. The writer of *Association of Ideas* retains the bulk of Croom Robertson's earlier essay;[25] and his additions are not particularly happy,—for under 'modern criticism' he refers only to Bradley, and under 'psychophysical researches' to James, Stout, and (misleadingly) to myself. There is no reference either to the modern introspective work or to Jung's association test. *Cognition* has four sentences. All these articles send us to *Psychology: Concept* now breaks the rule, and directs us simply to *Abstraction;* the article is slight. *Idea* supplements the central article by a couple of definitions; *Image* actually quotes from that article; *Imagination* falls distinctly short of it. The anonymous authors seem to have been especially troubled by the centaur: *Idea* tells us that "the idea of a centaur is a complex mental picture composed of the ideas of man and horse;" *Imagination* that "the image of a centaur is the result of combining the common percepts of man and horse." Professor Ward might have remarks to make on both these statements. *Intellect* again informs us of the contents of the general article, to which all the last-mentioned articles refer. The article *Judgment* is not psychological. There is no article *Memory*, though there is a long essay on *Mnemonics* (J. M. M.). There is no article *Thought;* both thought and judgment find passing mention under *Apprehension.*

The article *Action* is not psychological; and *Reaction* appears, so far as I have noticed, only as 'personal equation' in *Personality.*[26] There is no *Belief*, though the subject is mentioned under *Apprehension, Imagination.* There is a *Desire:*

[25] The reviser has crossed out Hartley's acknowledgment of indebtedness to Gay; and, in the article *Hartley*, has dropped a qualifying clause and a sentence which were valuable as giving the reader a just perspective. Condensation is all very well: but the Encyclopaedia contains such choice specimens of verbiage that these special instances of space-hunger are annoying.

[26] This article ends with the words: "Machines have been devised which make allowance for the error caused by the personal equation (see *Micrometer*)." The 'make allowance' is puzzling; and I find a reference to the eye and ear method not under *Micrometer* but under *Transit Circle.*—There is, I should add, a mention of association reactions under *Association.*

' for its technical use, see *Psychology.*' For *Gesture* we must turn to *Philology*. *Inhibition* is treated only from the legal standpoint. *Personality* refers us, ' for the psychological problem,' to *Psychology*. *Self* merely says: ' For the psychological use of the term, see *Psychology*, etc.' There is no article *Temperament*. There remains the article *Will*, to which I have already referred. This article (H. H. W.) is entitled *Will, in philosophy;* and we have accordingly no more right to ask it for a volitional psychology than we have to ask the article *Space and Time, in philosophy* for a psychology of perception. It contains, indeed, a section entitled ' Modern psychology,' but this merely discusses the relation of what the writer takes to be modern psychology to the problem of free-will.[27] We find, then, no special article upon the psychology of volition. And this is the more to be regretted, as the note on *Motive* interprets the results of " contemporary psychological research " in an unqualified and dogmatic way.

(3) The biographical articles seem to be much better done than the general run of the departmental and topical articles that we have been discussing.[28] I notice, however, that the bestowal of the name ' psychologist ' is capricious. *Bain* is not called a psychologist, although his " reputation rests upon his psychology." *Baldwin, Bonnet, Fortlage, Fouillée, Höffding, James, Ladd, Lazarus, Lewes,* the two *Mills, Robertson, Romanes, Steinthal, Wundt,*—no one of these men is termed a psychologist; our shelves are filled with the by-products of history, political economy, philosophy, physiology, literary criticism. Not that ' psychologist ' is a term of contempt; only

[27] In fulfillment of the editorial programme, one might have expected that the article *Determinism* would be put into the hands of some member of the Freudian school, or of someone who knew how to turn the *Aufgabe*-psychology to deterministic account. It is, however, an unsigned and non-committal article.

[28] There is still room for criticism, formal and material. Thus the revised bibliography of Adamson's *Beneke* is allowed to retain the statement: " In England, perhaps, the only writer who shows traces of acquaintance with his works is J. D. Morell." True when the article was written, it is not true today. And a question of literary ethics: Should a dead author's initials be appended to an article which has been—even slightly—changed, and whose bibliography contains works published after his death?

On the other hand, the unsigned article *Brown*, which is in all essentials a condensation of the article by Adamson in the ninth edition, omits Adamson's list of Brown's ' positive contributions to mental science.' On this topic Adamson was peculiarly qualified to speak, and the information would have been useful to psychological readers.

its application is casual. *K. G. Carus* [29] is psychologist and physiologist, *Huarte* is physician and psychologist, *Mach* is physicist and psychologist (though surely Mach, outside of physics, is an *Erkenntnistheoretiker*), *Münsterberg* is psychophysiologist, *Gurney, Ribot, Sully* are psychologists, *Waitz* is anthropologist and psychologist, *Ward* is psychologist and metaphysician. How purely casual the distribution is, we see from the article *Fechner;* the founder of psychophysics is termed 'German experimental psychologist.'

Of psychologists living when the text of the Encyclopaedia was prepared, Great Britain has mention of *Sully* and *Ward;* Stout, whose text-books and whose editorship of *Mind* make him, probably, the most influential of living English psychologists, has no article. France has *Fouillée* and *Ribot;* [30] Binet, whose untimely death we are now deploring, and Pierre Janet had earned a mention. Germany has *Wundt,* and a half of *Münsterberg:* that is all. Ebbinghaus, Lipps, G. E. Müller, Stumpf,[31] and on the applied side Meumann and Stern, might have been noticed; the omission of Stumpf is unpardonable. Austria has *Mach;* Brentano and Freud, to say the least, should have found a place. Denmark has *Höffding.* The United States has *Baldwin, James, Ladd,* and a half of *Münsterberg.* All these deserve mention; but then, indisputably, so does Stanley Hall.

The articles vary in merit. That on *Ward* strikes me as, of its kind, perfect; it tells, in brief compass, just what one wishes to know of its subject. That on *James* is inadequate; that on *Wundt* needs an adjective far stronger than inadequate.[32]

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[29] The initials should be *C. G.* The correction is trivial, as the name in question is *Carl;* but it gives me an opportunity to remark that the initials of the Encyclopaedia—so far as psychology is concerned—are not always trustworthy.

[30] I am glad to be able to place Professor Ribot here; the Encyclopaedia dates his death 1903.

[31] So far as I have observed, Stumpf and the *Tonpsychologie* receive textual mention only in the article *Aesthetics.*

[32] There are articles on *Charcot, Galton, Myers, Porter.* It may save some reader trouble if I add that I have looked in vain for Aubert, Delboeuf, Drobisch, Hering, Horwicz, Meinong, Mosso, Pearson, Richet, Sergi, Tetens, Volkmann, E. H. Weber. There is no attempt at a psychological appraisement of *Crusius, Priestley, Reimarus, J. L. Vives;* the latter's *De anima et vita* is not named. In truth, psychological perspective, whether geographical or temporal, is sadly lacking.

The article *Fechner* gives a brief sketch of Fechner's psychophysical and philosophical system, but refers neither to *Weber's Law* nor to *Metaphysics.* The article *Wundt* mentions Wundt's *System,* but fails to inform the reader that its contents are discussed under *Metaphysics.*

My general impression, after this survey, is that the new *Britannica* does not reproduce the psychological atmosphere of its day and generation. So far as psychology is concerned, the Editor protests a great deal too much. "The single-treatise plan . . . is not only cumbrous in a work of reference, but lent itself to the omission altogether, under the general heading, of specific issues which consequently received no proper treatment at all anywhere in the book; whereas the dictionary plan, by automatically providing headings throughout the work, under which, where appropriate, articles of more or less length may be put, enables every subject to be treated, comprehensively or in detail, yet as part of an organic whole, by means of careful articulation adapted to the requirements of an intelligent reader." "The whole work—and not only the unsigned articles, many of which indeed have . . high authority behind them—passed through the detailed scrutiny of the editorial staff, whose duty it was to see that it provided what those who used any part of the book could reasonably expect to find, to remedy . . 'inconcinnities' . . , and to secure the accuracy in the use of names, the inclusion of dates, and similar *minutiae*, which is essential in a work of reference." Yet we still find the single-treatise plan; we still find the 'omission altogether' of important issues; we still find 'inconcinnities,' not only of secondary articles with main article, but of two adjacent columns of the same article; and we find men signing articles and writing books some years after the recorded date of their deaths. Despite the halo of authority, and despite the scrutiny of the staff, I do not hesitate to say that the great bulk of the secondary articles in general psychology—articles of the type of *Affection, Apperception, Cognition, Intellect*—are not adapted to the requirements of the intelligent reader; and that many of them might as well have been left out. *Apperception*, for instance, is a topic that must be treated historically, and must be treated at some little length, if it is to be understood. The Encyclopaedia prides itself on its historical spirit: "all subjects are treated in these volumes not only on their merits, but as in continual evolution, the successive stages in which are of intrinsic interest on their own account, but also throw light on what goes before and after." Now turn to *Apperception:* consider how much you are told, in what technical terms, with what historical setting, with what kind and number of cross-references! And *Apperception* is a favorable specimen of its class.

I am not arguing that the *Britannica* should satisfy the claims of the specialist,—though there is specialism and to spare in articles which cover other fields of knowledge; I am arguing

that it lacks psychological atmosphere, that it has failed to reproduce the psychological spirit of its time. In America, we are told, "psychological study . . . has become largely a matter of experiment and apparatus." Now the work is dedicated, jointly, to the king of Great Britain and Ireland and the president of the United States; and the Editorial Introduction makes much of the adequacy of the new edition to American circumstances and needs. Moreover, "the object of the present work is to furnish accounts of all subjects which shall really explain their meaning to those who desire accurate information." Appears, then, the intelligent reader,—who asks for an account of this German-American movement in psychology, wishes at least to acquaint himself with its broader features; asks also for the meaning of the movement, wishes to understand the forces that lay behind it. What does he find? He finds—if it is not presumptuous to give my own impression—that the high authorities and the scrutinising members of the staff are well aware of the existence of laboratories, of activity in experiment, of publication of researches; but that they do not know any of these things at first hand. They are therefore a little timid, and they are also a little superior; they make general reference to the movement, where reference seems to them to be in place, but they add a wise word of conservative caution: 'All this is noteworthy,' they say in effect, 'but you must remember that experiments in the laboratory are, after all, artificial affairs; your subject there can never be quite natural.' The intelligent reader, being intelligent, is not satisfied; it occurs to him that the men who use a tool are likely to be aware of its limitations as well as of its scope and powers; and he asked for information and explanation, not for a bare reference and an expression of secondhand opinion. I have already quoted a characteristic sentence from the article *Child*. "Into the psychological characteristics and development of the child and all the interesting educational problems involved it is impossible to enter here." Why? for lack of space? But a whole quarter-page can be spared for a cut of the dandelion. Surely not because the subject is unimportant? Surely not because the intelligent reader will not be forthcoming? Surely not because expert guidance may be dispensed with?[33] Why, then?

[33] Here, indeed, is the usual caution: "There is often a tendency in modern 'child-students' to interpret the phenomena exhibited by a particular child with a *parti pris*, or to exaggerate child-study—which is really interesting as providing the knowledge of growth towards full human equipment—as though it involved the discovery of some distinct form of animal, of separate value on its own account." I suppose that we can find misdirected enthusiasm along all

The same general criticism may be advanced from another side. I have already paid my tribute of admiration to Professor Ward's *Psychology,* and Part 77 of the old *Britannica* has been familiar to me for more years than I like to count. But it is to be remembered that the *Psychology,* close packed as it is, is still no more than the outline of a system; printed in ordinary text-book style, it would fill, I suppose, less than 300 pages. It is not, then, to be compared with James' *Principles,* or Sully's *Human Mind,* or Ladd's *Psychology Descriptive and Explanatory,* or Jodl's *Lehrbuch;* "much that belongs to a full exposition is," as Bain remarked, "necessarily omitted;" and there are not a few "subtle disquisitions" which demand that elsewhere "illustration be duly expanded." I have tried to show that the secondary articles, considered as a whole, neither fill the gaps nor furnish the illustrations. But further: as there is now a large body of experimental work which bears upon Professor Ward's personal theories, so must these theories themselves take account of the experimental work which lies beyond them,—which has dealt with psychological problems as they arose to other points of view. Psychology today is less a coherent system of knowledge than a certain attitude of mind over against a vast collection of special investigations. And a systematic psychology which has not changed in a quarter of a century must either have been phrased, at the outset, in terms so large that the facts of observation are merely blanketed, or must hold its own by force of individual conviction against other systems that have like claims upon the impartial student. I need not say that the system of the *Psychology* is of the latter type. Professor Ward has shown, time and again, that he can come to close quarters with observation; certain results of his systematic thinking have been widely accepted; certain others have, as I think, been superseded. Here, again, therefore, was a pointer for the secondary articles. An article *Attention,* that should do full justice to the experimental situation, might yet keep in touch with the doctrine of the 'single subjective activity;' an article *Feeling,* with the doctrine of impresentability; an article *Action,* with subjective selection. I should be surprised to learn that Professor Ward's dissatisfaction with the secondary articles is not as deep as my own.

Who, then, it may be asked, was in charge of the psycho-

lines of human endeavor. But imagine yourself enquiring the way to a certain place, and being told: You are on the wrong path, but it is impossible here to put you right! And imagine this reply from an official whose business it is to direct you!

logical portion of the Encyclopaedia? We are not told. The Editorial Introduction gives a long list of specialists who assisted the Editor on all sorts of subjects,—natural science, art, and literature, history, applied science, mathematics, philology and languages, and so forth; but in all this 'college of research' there is no psychologist. The Introduction also names the members, English and American, of the editorial staff. I failed to recognise a psychologist; but, to make assurance doubly sure, I traced the departments for which a single authority is declared responsible, and I find that psychology is, in fact, not among them. The inference seems to be that no one in particular was in charge of the psychological contributions to the Encyclopaedia. If this inference is just, —if the failure to mention a responsible editorial assistant is not simply an oversight,—then the Editor's attitude to psychology is made clear, and the defects and errors which I have pointed out, glaring as many of them are, become intelligible. But a twentieth-century Encyclopaedia that has no psychologist either upon its advisory board or upon its editorial staff is, in so far, an anachronism.

APPENDIX

A. G.	Major A. G. F. Griffiths, late H. M. Inspector of Prisons.
A. L.	A. Lang, British man of letters, author of works on folklore, primitive religion, etc.
A. M.	A. Macalister, Professor of Anatomy, University of Cambridge.
A. S. P.-P.	A. S. Pringle-Pattison, Professor of Logic and Metaphysics, University of Edinburgh.
B. K.	B. Kidd, author of *Social Evolution*, etc.
C. L. M.	C. Ll. Morgan, Professor of Psychology, University of Bristol.
C. P.	C. Pulfrich, on staff of C. Zeiss Factory, Jena.
E. B.	E. Bramwell, Asst. Physician, Royal Infirmary, Edinburgh.
E. B. T.	E. B. Tylor, Professor of Anthropology, University of Oxford.
E. M. S.	Mrs. Henry Sidgwick, Principal of Newnham College, Cambridge.
F. P.	F. Podmore, author of *Modern Spiritualism*, etc.
F. Y. E.	F. Y. Edgeworth, Professor of Political Economy, University of Oxford.
H. H. W.	Rev. H. H. Williams, Lecturer in Philosophy, Hertford College, Oxford.
J. B. T.	Sir J. B. Tuke, Medical Director of New Saughton Hall Asylum, Edinburgh
J. E. C.	Rev. J. E. Carpenter, Principal of Manchester College, Oxford
J. G. M.	J. G. McKendrick, Emeritus Professor of Physiology, University of Glasgow.

J. M.	J. Macpherson, formerly Inspector-General of Hospitals, Bengal.
J. M. M.	J. M. Mitchell, Lecturer in Classics, E. London College.
J. R. C.	J. R. Cotter, Asst. to the Professor of Physics, Trinity College, Dublin.
J. S.	J. Sully, Emeritus Grote Professor of the Philosophy of Mind and Logic, University College, London.
J. W.	J. Ward, Professor of Mental Philosophy, University of Cambridge.
J. We.	J. Welton, Professor of Education, University of Leeds.
L. C. B.	L. C. Bruce, author of *Studies in Clinical Psychiatry.*
N. W. T.	N. W. Thomas, Govt. Anthropologist to Southern Nigeria.
R. R. M.	R. R. Marett, Reader in Social Anthropology, University of Oxford.
S. C.	S. Colvin, Keeper of Prints and Drawings, British Museum.
W. D. W.	W. D. Whitney, late professor of Sanskrit and Comparative Philology, Yale University.
W. McD.	W. McDougall, Wilde Reader in Mental Philosophy, University of Oxford.

Note I.—The Index Volume comes to hand as I am correcting the galley proof of this review. It contains (pp. 939 f.) an alphabetical list of the articles in Philosophy and Psychology; Subjects and Biographies are separated; Philosophy and Psychology themselves, despite the article *Philosophy*, are thrown together. It seems that I have found all the psychological articles, but have missed half-a-dozen that deal with Psychical Research and Occultism.

I have worked out the references under the topical heading Psychology (p. 640), and under a number of special headings; there has not been time for a thorough search. I find that the general heading gives the sub-headings *Ethics, relation to; Logic, relation to; Metaphysics, relation to,*—and as I have not mentioned in the text any discussion of the relation of psychology to other disciplines, I am glad to repair the neglect here. The article *Ethics*, then, devotes twenty lines to psychology; ethics, we are told, must hold its ground against the intrusion of ideas from alien sources, and the conviction of 'the ultimate character of moral obligation' "may produce quite unforeseen results for psychology." *Logic* informs us that metaphysics, logic and psychology form together a 'triad of sciences;' the interdependence is "so intimate that one sign of great philosophy is a consistent metaphysics, psychology and logic." A paragraph under *Kant's Logic* treats of the post-Kantian psychological logic. *Metaphysics* teaches that "to proceed from psychology to metaphysics is to proceed from the less to the more known; and the paradoxes of psychological have caused those of metaphysical idealism." These brief notes must suffice.

The Preface admits that "every index has its humors:" here is an illustration. There is a sub-heading *Pioneers of Physiological Psychology*, and the names to which reference is made are A. Bain, F. E. Beneke, and J. Huarte.

Note II.—I am informed that the error in the statistical tables under *Insanity* appears in the English edition, and was discovered and corrected by the New York office after the American reprinting had begun. Early American sets thus contain it, while later sets are correct.

THE FUNCTION OF THE SEVERAL SENSES IN THE MENTAL LIFE[1]

By EDMUND C. SANFORD

In the following paragraphs the author attempts to sketch the functions of the several senses in the general mental economy, in somewhat the fashion in which a field naturalist might describe the rôles of the several forms of animal and vegetable life in some district under his observation. He begs the reader's indulgence, therefore, if he speaks first for a moment about well-known matters in order that both may start from common ground.

We have, as everybody knows, sensations of sight, hearing, smell, taste, and touch, sensations arising from posture and movement, and in addition, sensations of pain and indefinite general and organic sensations. We know that through these in various measure we receive impressions from the outer world and from our own bodies, that in response to data furnished by them we adjust ourselves to the world about us by means of movements and that in images derived from them we do a large part, at least, of our thinking.

Our first question is: *What part of these images, in which we do our thinking, does each sense furnish?* We are not especially interested to follow back the sensory elements to their utmost simplicity, but rather to study them in their combinations, in the perceptive and other complexes in which we always find them when we can actually observe them.

Let us take the senses one by one beginning with touch.

Touch is a sense world in itself. We group together under that name sensations of heat, cold, pressures and contacts,

[1] This essay has been read, in substantially the form in which it here appears, as a lecture before the departments of psychology in several colleges and universities. Besides the works referred to in the text, the following have been drawn upon in its preparation:

Obersteiner: *Zur vergleichenden Psychologie der verschiedenen Sinnesqualitäten*, Grenzfragen d. Nerven- u. Geisteslebens, VI, 1905, Heft 37, 1-55.

Kant: *Anthropologie*, Werke (Hartenstein Edition), VII. 465ff.

Wundt: *Grundzüge d. physiol. Psychologie, passim.*

Ribot: *Evolution of General Ideas*, tr. by Welby, Chicago, 1899.

The author would also note his indebtedness to his friend Professor Henry Taber of the Mathematical Department, Clark University, for helpful suggestions.

all of which show local differences as one part of the skin or another is stimulated. From the dermal surfaces we also get pain of a definite kind. In active touch we not only have these passive experiences, but a whole new set as well, giving us information as to the position and movements of our members.

Passive touch is a sense of great immediacy. With the partial exception of heat and cold, it responds only to excitations that are applied directly to the skin itself and reach the nerves directly, or through but few intermediaries, as simple mechanical excitations. Mechanical stimuli must of course, like all other kinds, suffer transformation into nervous processes before they can reach the conscious levels of the central nervous system, but this simplicity and immediateness are not without their significance.

Touch resides in what is by far the most extensive of the sense organs,—the whole dermal covering of the body and much of the mucous surface,—and what is still more important, it has a very close and varied connection with the muscles. It has been plausibly conjectured that an important factor in the tactual "local sign" or special difference in character by which any given dermal impression is referred to the one part of the body surface to which it belongs, is a reflex tendency to bring the hand to the spot stimulated or to turn the eye so as to look at it. The same motor connection is shown by the violent start of surprise that follows an unexpected touch. There is hardly anything that will produce a more violent and general muscular contraction than a fully unexpected slap upon the shoulder. The shortness of touch reaction-times probably points the same way, as do, certainly, the variety of reflexes that follow dermal and mucous excitations. All this in the case of mere passive touch,—where the sensory surface simply receives what comes to it. With active touch the connection is still more intimate. The inner touch sensations (the capsular, muscle, and tendon sensations) are not only directly dependent upon bodily movements for their specific stimuli, but supply one of the handles by which we manipulate our members in voluntary movements. Interference with the usual inflow of sensations from the members in movement makes the movements themselves uncertain or impossible, except as vision serves as a vicarious guide. Touch, active and passive together, is preeminently the sense of closest motor connections. This also has its important meaning in the psychic life in general.

In another particular the sense of touch is peculiarly endowed. It is the only sense that has an organ that can

be doubled upon itself. The eye cannot see itself; the ear cannot hear itself; nor the tongue taste, nor the nose smell itself; but the hand can pass over the whole body surface, and in so doing both feel and be felt. The eye can, in a secondary fashion, see the body surface and follow and guide the movements of hands and feet, and the ear can hear and control indirectly the sounds that the vocal apparatus produces; but the touch surfaces alone can perform in perfection this ultra-philosophic feat of being at one and the same time both subject and object. The feelings of double contact that arise when two touch surfaces are brought together have, like the immediacy of stimulation and the close connection with muscular movement, a special meaning in the psychic life in general.

Touch has also other characteristics that are perhaps worth mentioning in passing, though their connection with our main problem is not so close. In power to stir emotion the sense stands high. A cool plunge into a swimming pool, the warmth of an open fire, a caress on hand or cheek, the kiss, the embrace, the shock of personal assault all testify to this. Touch is intimate; what stimulates our dermal surface concerns us closely. It touches us in more senses than one.

Touch is a sense in which man exceeds most of the animals. Others may excel him in keen discrimination of odors; perhaps others in vision; but few can compare with him in touch. It is hardly necessary to recall the general covering of fur, feathers or scales that most of the other animals have, and the inadequacy of fins, claws, paws, lips, or even of probosces, for fine palpations. And with the monkey tribe the hand, though ready in form for touching, is not yet free from general bondage to locomotion. There are a few exceptions. Prof. Whitman has showed an astounding sensibility to touch or jar in certain leeches; but as against most animals man's superiority still holds. Manual deftness in the surgeon or in the engraver is not alone a matter of eye and of muscle but of refined tactual sensibility as well.[2]

[2] I remember reading many years ago of a cracksman who was able by touch to discover the combinations of the safe locks then in use. He scraped down one of his finger nails almost to the quick, and holding this against the lock was able to perceive the faint jars produced by the movements of the inner parts of the lock as each was brought to the point required for opening. To learn the combination was then but a matter of a few trials, and the safe was open. Whether this story is true, I do not know, but there is no prima facie impossibility in it. At all events the main point stands that the hand is not alone a tool-holding mechanism but a sense organ of high power.

Touch is also a very ancient sense. It begins far back in the animal series, and is active from very early in the individual life history—at first in the tongue and lips, later in the hands and fingers. It is perhaps a mistake to regard it as the mother sense of all the other senses, as is sometimes done. The unicellular creatures react to light and chemical excitants as well as to contacts; and one is hardly justified in saying that everything comes from touch more than to say that everything comes from the primitive capacity to see or to taste and smell.

Nevertheless the statement seems to carry some truth with reference to two of the senses, the rotational-equilibrium sense and the auditory sense, both of which have their end-organs in the inner ear. The morphological series that connects the one with the other seems to have been made out with some exactness. The dermal surface first develops a little sensory pit which later in the series becomes closed in and sometimes contains a granule of calcareous matter. The organ thus formed serves indifferently as an organ for sensing bodily movements or for shocks and jars coming through the surrounding medium. To serve one of these functions come, in course of differentiation, the semicircular canals of the inner ear and their connected parts, still an organ for the indirect regulation of bodily movements, especially those involving rotation and the maintenance of equilibrium, and for the other, much later, the cochlea and the mechanisms responsive to the aerial jars that we sense as sounds. The functional relation is so close between the kinæsthetic organs of the inner ear and those of inner touch (the capsular, muscle and tendon senses) that the derivation seems not unnatural.

In the case of the auditory part of the ear the connection is much more remote. The auditory part of the ear is at most the grand-daughter and not the own daughter of the sense of touch. And yet it maintains at one or two important points the family resemblance. It is still a mechanical sense and responds to actual mechanical impressions upon the nerves, though very delicate ones, and it is very closely connected with the general muscular system both in the central terminations of its special nerves, and in the outer physiological effects of its stimulation. A sudden and loud sound produces as violent a start of surprise and terror as an unexpected blow; babies wink at sounds long before they do to threats at the eye, and start and begin to cry at the slamming of a door. The auditory reaction-time is as short

as the tactual, and probably for the same reason. And perhaps most interesting of all, rhythmically repeated sounds enter in through our ears and play upon our muscles for themselves, compelling us to keep time to them whether we will or not, and giving to rhythmically repeated sounds and movements the profound power over us which they undoubtedly exercise.[3] And finally hearing, like touch, is a sense that is always exposed to excitation and one that can obtain no mercy when within the range of its stimuli.

The differences are, however, no less fundamental. If the ear is still a mechanical sense, it does not require immediate contact with the sound-producing object; it receives at long range the air vibrations that betray the latter's presence; its sensations, therefore, bear a more objective and impersonal character. It tells us of events in the world at large and not so much of our own states and activities.

Because of the biological advantage of this long range function, the ear has gained in keenness and in variety of sensibility until its contribution to the mental life has reached large proportions. Because of the same refinement and range of sensibility it has become also a sense of indirect perception and of sensory inferences; we infer by their sounds many things which we do not otherwise sense; to take single instances, we know it is raining by hearing the patter of the rain on the roof, and the doctor diagnoses the condition of the organs of the chest from the sounds of heart and lungs. And the most important contribution of the ear to the mental life in general—one of transcendent importance—is in a measure but a further development of this habit of indirect perception—I mean the verbal signs of language, which it has developed in coöperation with its special motor partner, the voice. Of language I shall have more to say presently; I merely mention it here, and pass on to speak of vision.

Vision, like touch, is a sense of ancient lineage and of early development in the individual life. Like hearing it is a long range sense, taking note of things not directly but through the operation of the light which they emit or reflect. Unlike touch and hearing its connection with the general muscular system is not particularly close; but in compensation it has a tolerably complex motor apparatus of

[3] A slightly different example can be found in the effects of the crack of the whip and the pistol shots on the behavior of the big cats in Bostock's and other similar groups of trained animals. One can fairly see the sound stimulus playing upon the reluctant motor centers of the animals and forcing them to do in spite of themselves the things which the trainer requires.

its own. In its original function as a light perceiving sense it is as far as possible from the mechanically stimulated sense of touch; and yet it has in the retina an extended sensory surface not unlike the skin, and this, with its correlated muscles, gives vision a certain physiological analogy to touch. From very early in life also it exercises a supervisory function with regard to that sense, and in course of time comes to be very closely bound up with it, and indeed fully to justify its description as "anticipatory touch." In giving us chiefly a spatial world of things, it also stands very close to touch—much closer than does hearing. But like hearing, again, it has developed an immense power of secondary or inferential perception, far more indeed than has the ear. It thus becomes the general business sense of the mental world; and can serve on occasion directly or indirectly in some degree in place of almost any of the rest. Things look hot or cold, rough or smooth, appetizing or disgusting, one is aided in understanding a speaker by watching his lips, etc., etc.

In its own field its chief characteristic is the clearness and precision of its data. Beside it the other senses are dull and groping. It furnishes the very standard by which we measure intellectual comprehension. When a thing is as clear as day, i. e., as clear as seeing by daylight, it can be no clearer. This clear precision it probably owes, on the one hand, to the microscopic fineness of the retinal elements, and, on the other, to the dominant control that vision usually has over attention. Its contributions to the general mental life rest upon the three following qualities chiefly: that it is a long range sense, dealing with a world of outer things; that it is a sense that serves readily, though indirectly, for other senses; and that it is a sense that usually carries attention with it.

Of the senses of smell and taste there is little that need be said here. Smell is without doubt in man a survival—a sense that once stood high and is now for practical purposes almost negligible. Phylogenetically, and in certain creatures yet, it far outranks even vision as a long range sense. Under its influence it is probable that the development of the cerebral hemispheres themselves began. Time was when the nose was the organ of mind. It seems to have lost this leadership when man took his erect position and lifted his nose from the ground. For civilized man, at any rate, both taste and smell might be lost with very small inconvenience, though perhaps with some slight loss of pleasure.

Of pain and the general and organic senses we must say

a little more. To pain it belongs more than to any other sense to mould behavior directly, though it works, in a negative way, forbidding, like the demon of Socrates, certain courses of action, without recommending others except by implication. In compelling power over attention it exceeds vision itself a hundred fold; and it gives to the mental life, as to life in any of its aspects, a color of stern reality. To treat my topic fully I ought to speak of this in detail, but I am not prepared to do so; it would take a book to discuss it adequately, and I must also for the rest of my space limit myself rather to the intellectual aspect of the mental life, and neglect the emotional and the volitional.

For much the same reason I shall have little more to say of the general and organic sensations than to remind you that they resemble in quality the various forms of touch; and that with the dermal and kinæsthetic senses, they form, on the one hand, the substance of our sensory experience of ourselves, and, on the other (as the sensory basis of emotion) the staple of our life of feeling.

We have now passed in review the chief senses and have indicated some of their characteristics. Let us as the next step take two or three sorts of mental experience and see how the several senses stand in regard to them. First of all dreaming. Most dreams seem to be chiefly in visual terms. Hearing occurs frequently, but most often as the hearing of spoken words. Touch sensations are present by implication, but are not usually in the focus of consciousness. General and organic sensations are present in the same implicit way, in emotions and bodily consciousness of self, but rarely otherwise. I do not know whether images of pain are ever present in reality; and at any rate one not infrequently wonders in his dream at the painlessness of conditions that he thinks ought to be painful. In dreams as in waking life vision is clearest, and largely monopolizes attention; hearing is present as the social and language sense; and touch and organic sensibility, unilluminated by attention but nevertheless operative, form the background, especially of emotion.

If we turn from the common hallucinations of dreams to the less usual ones of the waking life, such as have been collected by the Society for Psychical Research, we shall find vision again leading, with audition second and the rest

behind.[4] And even with the insane the only difference is the interchange of relative frequency between the ear and eye.

Of illusions (the mistaken perception of a real object as opposed to inner creation or hallucination) the eye seems to possess an almost undisputed monopoly. We hear of optical illusions till we might think there were no others. It is strange at first approach that this clearest of all senses should be thus subject to illusion, but the reason is not far to seek. The eye is easy to fool because so many of its perceptions are inferential. A little something unusual in the data or a little something omitted leads to a false inference. The eye owes its wealth of illusions to its superlative power of indirect perception. It has the defects of its virtues.

The chief characteristics of the different senses come out again in the fine arts that they subserve. Based upon sight we have the two great arts of painting and sculpture, and that part of architecture that is devoted to beauty of form. It is, however, as representative that these arts make their most direct appeal to us. The beauty of color or form alone, while not to be neglected, is a comparatively small factor. It is what the picture or statue means or suggests that moves us. With nothing more than the pure visual sensations, the visual arts would have remained on a low level—perhaps hardly above the level of simple decoration. They rise above that in proportion as by representing something they reach the broader and deeper human interests. (I am speaking here, of course, of the normal response of the naïve observer. For the artist or critic there is a special "professional" pleasure in the skill of the execution and the particular way in which the artist produces his effects. This pleasure is mediated by vision, but is, of course, intellectual rather than sensory in its quality.)

The peculiar art of the ear is the art of music—an art that makes an especially direct appeal to us (partly through rhythm and partly through the roots it sends down into the primitive emotions through its resemblance to the vocal expression of emotion). It is not compelled like the arts of form to represent something; it works upon us directly. The nearest approach to a purely visual art corresponding to the auditory art of music is to be found, as Santayana sug-

[4] It should be noted, however, that Parish (Hallucinations and Illusions, London, 1902, p. 108) holds that visual hallucinations are not more numerous, but merely more frequently noticed and better remembered.

gests,[4] in the art of pyrotechnics, i.e., fireworks, where form, color and movement are united to produce pleasure by their immediate effects and not by representing something else. Poetry, like music, belongs to the ear, but by means of language (auditory symbols in the first instance) it can appeal indirectly to all the senses and becomes representative like the visual arts. The drama gives pleasure, of course, to both eye and ear; and dancing to the eye and vicariously to the muscle sense. (Again I am speaking of the pleasure of the naïve observer; the professional has his professional pleasures as before; and in music there is for those who can follow it the musical logic in the development of the theme and of the musical form as a whole.)

The art development of the remaining senses is rudimentary and need not detain us.

You will notice that the arts that appeal to the eye depend upon its facility in sensory inference; while music, in its purest form, depends more directly on the ear and its powers of reading movement and emotional condition in the changes of inarticulate sounds.

And now the reader may perhaps be asking why I do not try to arrive at the function of the two chief senses at least, by the method of elimination—why I do not consider the mental life of those who have lost sight or hearing or both. I am ready to speak of them here, and they will serve to show us some important aspects of the mental life, but not quite in the way implied. The fact that comes out most clearly of all, when we study the cases of those who have suffered the loss of one or both of the chief senses, is the *smallness of the loss in any case for the mental life as a whole,* provided only that circumstances have been such as to supply sensory experiences of some sort in sufficient variety. Let us take extreme cases. Take Laura Bridgman and Helen Keller: What of a full mental life do they come short in? Practically in nothing but in the particular sort of bare sensory experiences which their misfortunes have cut them off from, and this is really very little; certainly they are not defective in any essential element of a full human mental life. They can think and feel as vividly and through as wide a range of feeling and thought as any one. What shall we say to this? Two things: In the first place they have retained the sense of touch which in a short-range way can serve for all dealings with the world of people and things, and, when

[4] Santayana: *The Sense of Beauty,* London, 1896, p. 75.

trained, can serve as a language sense equal almost to hearing itself. And secondly, and this is the point to which I wish to draw special attention now, *the developed mental life is not a matter of immediate sense experiences* but of the representation and manipulation of sensory and linguistic symbols. The sensory experiences furnish materials for the manufacture of symbols; and the mental life, at least on its intellectual side, consists in manufacturing and correlating them. As a general thing it matters comparatively little what sense furnishes the material for the symbols, provided that it is furnished. In normal cases material for symbols of different kinds comes in through the different senses; especially through hearing and vision. Without special training, i.e., without the furnishing of touch language symbols, etc., persons with defects like those of Laura Bridgman and Helen Keller are predestined to very imperfect mental development.

The symbols derived from the different senses long bear the marks of the senses from which they spring. It is to the characteristics of some of these symbols and the manner of their development that I wish to devote the rest of my space.

First let us start with simple perceptions and see how a symbol of some abstractness gradually grows up. To perceive a thing is in some sense to take it out from its setting and to regard it, in attention at least, as a separate thing. In those sense fields where a considerable variety of sensation is possible, the whole mass tends of itself to break up into separate groups of a more or less permanent nature, and instead of a variously featured whole we get a mass of separate things. We see a room full of furniture with pictures on the walls and books on the table, for example, and not a mere variegated visual field. But of these separate things, even, we do not get photographic copies. We get instead mere sketches in which certain aspects are sharply and clearly brought out, and others are barely indicated or wholly omitted. The sense groupings are determined in a general way by our environment, but they get a special perspective in their parts that is dictated by our human needs and purposes. Things are perceived with an implied meaning, and that meaning is dictated as long as we are on the common practical level, by what we can do with the things or what they will do to us. It is said that a savage's first questions with regard to a new object are apt to be; "Will it hurt me?" and "Can I eat it?" This is doubtless a slander

on the savage; nevertheless it caricatures a characteristic mental attitude and one that leaves its impress on all our percepts. We look at a chair as something to sit upon, and we usually neglect the fact that it is also a wooden object and may, in case of need, be used for making a fire. We look upon sheep in the pasture and mutton on the table as quite different things, neglecting in each case what is prominent in the other.

These last examples are cases of what psychologists commonly call apperception—the perception of a thing with a meaning—but perception and apperception are in reality the same thing and pass into each other by imperceptible gradations. There is no essential difference in kind, merely one of complexity, of degree, between the simplest case of perceiving a taste or smell and apperceiving a social action as one which is in the long run detrimental to the common good. Perception and apperception consist essentially in omitting certain aspects and retaining and emphasizing others, omitting those that are unimportant for the matter in hand and stressing those that are important—those that have (or constitute) the meaning.

And we need not stop here. This is the same sort of selective action that is operative in the formation of all concepts and abstractions, or symbols, of objects and relations. We abstract, or pick out by attention certain aspects of our knowledge about chairs for our common dealings with them, we neglect others. We take certain essential aspects of concrete cases of just actions to form our concepts of abstract justice, and leave those that are not essential. We take certain aspects of actual physical objects to form our concepts of matter, and we leave out the rest. We take certain other aspects of groups of things as the basis of our abstract concepts of number, and neglect all the other aspects. And so with all the rest. Only one further step is necessary to the completion of general concepts, however general and however abstract; and this is one that often takes care of itself, namely, that the instances in which like aspects appear should somehow come together and be associated, and then get some sort of a distinctive name or language symbol.

This is as far as we need to follow the process at the moment. When we have once gotten our name or language symbol we can do pretty much what we like with the concept so long as we do not separate it from its definite meaning, and so long as we keep the way open for a return to the concrete experience when we need. Ribot, if my memory

serves me right, has compared the whole process to the development of the different means of managing commercial exchanges. At first there is simple barter; things are swapped for other things. Then one of these, perhaps the most frequently exchanged, is taken as a measure of value; so many cows, for example, for so much grain, or so many for a piece of land. Later bullion is substituted for cows, as more portable and more universally desired; then by and by coined money. Later still come paper money, bank checks and other evidences of credit. These add greatly to our convenience, but one and all have value only in so far as they rest upon an adequate basis, and can, in case of need, be turned into the various concrete valuable things for which they stand. Similarly with the abstractions and their symbols; they facilitate thinking, but have a genuine meaning only as they can be reduced in case of need to the concrete experiences from which they were originally drawn.

Now let us return to our chief sense modalities and ask for the special concepts that each furnishes, that we may see how far these carry the marks characteristic of their origin, as I have said they do. From touch and sight in coöperation we get our conceptions of space and movement; from touch and the kinæsthetic group of senses the fundamental qualities of matter—impenetrability, mass, weight, inertia, force—and from the kinæsthetic group, in free or hindered movement, our sense of personal freedom or constraint. A blind and deaf man might be a physicist; it is doubtful if a totally anæsthetic and paralysed man could be, because he could not frame the fundamental physical ideas, or if he would have any idea of personal freedom. From touch also come our fundamental ideas of reality. That which can be touched and handled is real for any doubting Thomas; that which can be seen or heard but not touched is a ghost. If we all, in spite of efforts to the contrary, take matter as the prime type of reality and refute Berkeley by kicking a stone, it is because we instinctively fall back upon our primal sense of touch.

Touch furnishes us, as I have said, a considerable part also of that mass of fused sensations that constitutes our perceived selves, though vision also and the other senses do something. It is here that the feelings of double contact are important. From our own persons we get double contact sensations, from all else single. We feel and see parts of ourselves, and we live in a peculiar way in the parts of our persons that we can feel and see. One of Du Maurier's

pictures in *Punch* represents a little girl trying not very successfully to tie her sash behind her back. She finally appeals to her aunt who stands by. The aunt replies: "Why, Alice, you are such a big girl now, you ought to be able to tie your own sash." To which the little girl retorts: "How can I, Aunty, when I'm in front." We are all of us chiefly in front. And yet even touch itself furnishes but the outer and less important part of our empirical selves. A deeper self is the self of feeling and emotion, the self that loves and hates, that strives and aspires, that enjoys and suffers; and for this another group of senses is chiefly responsible—that inner group of general or organic sensations. It is of the reverberations of excitations within the field of these inner senses that the moving part of our emotions is constituted. The loss of feeling robs us of all that part of ourselves that makes life or anything else valuable. And that part of ourselves we owe chiefly to our general and organic sensations.

To sum up briefly I may say that we get from the chief senses singly or in coöperation four characteristically different abstractions: From touch we get the world of space and material reality, and force acting upon us; also, from motor touch, energy, active efficiency and freedom; from vision we get space and the world of things, though in a somewhat different way from that in which touch gives them to us; from hearing we get our symbolic machinery of thought; from the general and organic senses, our most intimate intuitions of ourselves and the basis of our emotions.

We can tell whether these bear the marks of their sensory origin only by thinking of the meaning of them and seeing whether they still carry a sensory suggestion. Matter and solid reality, when I myself try to give them definite meaning, suggest at first something visual and then if pressed further something palpable, something that resists movement. Freedom suggests free swinging of the arms and body movements, and efficiency something like a physical pushing. Unfilled space, if taken as remote, is that which can be seen through, and, if near, perhaps in addition that through which the hand may be thrust. The feeling self resides for me in the chest, or at least "in front." These are but a few illustrations, but there can be little question that these abstractions all carry the marks of their origin, or still lie close to it; and it is but natural that they should do so, since they have been reached by a process of subtraction of temporarily unimportant aspects. These special cases are of course all instances in which we have been trying to get a somewhat

concrete meaning for our abstractions, to exchange our paper money for coin. But at the same time we must remember that it is only as we can ultimately reduce them in some such way that they really have any meaning at all.

But now assuming that sensory marks remain upon most abstractions, and sensory experiences furnish them with such meaning as they have, what follows from it? I reply that certain very definite limitations follow from it. I tried in a paper several years ago[5] to show that the symbols (or abstractions or concepts) of physics had an underlying basis in the experiences of the dermal and kinæsthetic senses, and for that reason physics could not be expected ever to be able to furnish a full and satisfactory explanation of psychic experiences derived from other sense modalities; in brief, that we never could get a satisfactory explanation of the whole psychic life in terms of matter and motion, the fundamental concepts of physics. We cannot, for example, expect to explain the quality of a taste or a smell or a pain in terms of sensations of pressure or of the kinæsthetic group, much less all psychic life. The concepts of physics tend, in a word, to state all physical phenomena in terms ultimately reducible to dermal and kinæsthetic experiences, and by that very fact physics is prevented from explaining anything that lies outside the field of dermal and kinæsthetic experiences, because of the impossibility of translating one sort of sensation into another sort. It is *disparateness in sensory origin of the concepts* that makes the great gulf which has been said to lie between the self and the external world. We can leave out what we like in forming any abstract concept, or symbol, but we cannot leave out everything; and what we retain fixes the field in which the laws that we reach by use of that abstraction will prove necessarily applicable.

We can in some cases indeed transfer meanings and use symbols derived from one sense as carriers for meanings derived from another sense, as for example, when we treat geometrical relations by algebraical symbols in analytical geometry. But this is merely a transfer of the language signs, i.e. of the signs of symbols, and not of the original symbols themselves. In every case the meaning must come from somewhere (i.e., ultimately from some sensory experience) and the meaning then gives limits to the symbols as if they had originated along with it.

What I have just said of the limitations of physics is true, however, only in so far as physics finds its problems in

[5] *Psychology and Physics,* Psy. Rev. X, 1903, 105-119.

dermal and kinæsthetic experiences, that is in the physical world as we know it. There may come very likely a stage at which a metaphysical or transcendental physics will arise in which the symbols will be varied arbitrarily, and then the specific marks of the physical senses may be left out. Mach, in his little book on "Space and Geometry," suggests such a development.[6] Something of the kind seems actually to have taken place already in the symbolism of mathematics, where the abstractions have been carried to a very high degree of tenuity and where symbolism has been most diligently elaborated. In the work referred to, Mach shows in interesting fashion how geometrical space has grown up from our original physiological apperception of it, and how the science of geometry has developed. from the practical necessities of land surveying and other measurements, suffering gradual transformation also, until now it is a science of pure space—a science that criticizes and experiments with its own concepts, and gives us geometries of spaces that we never experience —spaces that are curved, in which parallels may meet, and in which there are four, five or n dimensions. These are of course as far beyond immediate intuition in thought as they are beyond direct perception by the senses. It has become a mere question of the relations of symbols to which certain meanings (and not necessarily spatial meanings) have been reserved, while other and practically necessary ones have been omitted.

In the modern theories of number mathematical symbolism has perhaps reached a still higher pitch of abstraction. There, it would seem that everything has been reduced to a concept of sequences, or as we might phrase it psychologically, to concepts of change according to a certain law, or principle. It need not be change of direction, nor of quantity, nor of quality, but simply change according to some plan. And the interesting point for psychology is that the mathematicians seem here to have been able to shake off at last the special marks of the outer senses, and to have retained as the sole content of the concept attenuations of a purely inner and subjective character, i.e., aspects of sensations in general. The supersensual developments of geometry above referred to seem to have reached nearly this same pitch. The mathematicians would say at once that the formulas of transcendental geometry apply to any sorts of manifolds with aspects related in the ways represented by the symbols, not to space alone. Considered psychologically the progress of the mathematical con-

[6] Mach: *Space and Geometry*, tr. by McCormack, Chicago, 1906.

cepts has been from those distinctly empirical and of the senses, by gradual elimination of the sensory elements, to those that are distinctly reflective—distinctly of the mind, to mental forms in the sense of Kant. They are symbols of relations, perceived by the inner eye of conscious attention, not of external objects of sense. The progress has been from without inward. And this tendency is inherent in the development of all concepts provided that they are pushed far enough and made abstract and general enough, i. e., if enough is left out of them. Beyond these general subjective forms, however,—fundamental characteristics of all varieties of sensory experience,—even mathematical abstraction cannot go, because to leave out these would be to make the concepts entirely empty and void of meaning. Beyond these lie only the fundamental conceptions of pure logic, which are by profession contentless and for which the experience of cognition is in itself a sufficient psychological source.

THE RELATION OF PRACTICE TO INDIVIDUAL DIFFERENCES

By FREDERIC LYMAN WELLS, Ph. D., McLean Hospital, Waverley, Mass.

A fundamental problem of experimental psychology has to do with the way in which individual differences are produced. In general, it is apparent that such differences are manifestations, on the one hand, of differences in original nature, where heredity plays perhaps the predominant part; and on the other hand, the product of special education and experience.

On the mental side, the various psychological experiments afford us measures of individual difference in the particular functions with which they may be concerned. The question at issue concerns the extent to which these differences, as we meet them in every day laboratory experience, may be fundamental, inherent in the original nature of the individual, or may have been produced by special environment and training.

Some light on this question is here sought through the medium of the practice curve. Given functions in which the individual differences are sufficiently distinct, and in which the normal performance lies sufficiently far from the physiological limit, the following postulates may be formulated:

(1) The nearer the subject is to the end of his practice curve, the less prospect of improvement he has before him; and the further he is from the end of his curve, the greater his prospect of such improvement.

(2) If a high initial efficiency is the product of greater practice, then the expectation of further practice inprovement is small; conversely, if a low initial efficiency is the product of lack of practice, then the expectation of improvement under special practice is great.

(3) If, on the other hand, a high initial efficiency be the product, not of a greater amount of practice, *but of greater ability to profit by a given amount of practice,* then the expectation of improvement under special practice is great; and conversely, if a low initial efficiency be the product of

little ability to profit by practice, then the expectation of improvement under special practice is correspondingly small.

The experimental problem is, then, to examine the relative frequency of application of the two latter propositions, not, of course, regarding them as mutually exclusive. This may be attempted in studying the practice curves of suitable tests in a number of subjects, observing the relation of initial efficiency to the amount of practice improvement.

The special precaution that must be taken in selecting such tests is to see that the most efficient performances in the normal distribution do not lie too close to the physiological limit of efficiency. If this be the case, as it is for example in the free association test, the poorer performances will simply catch up with those which are already near the limit; and while this has its specific effect upon the individual differences, it is not subject to interpretation by the above reasoning. As a criterion in this respect, the present experiments would suggest that the highest efficiency reached during practice by some subject should be at least twice as great as the highest efficiency of any subject at the beginning of special practice.

This condition is best met in the complicated arithmetical problems, where the physiological limit is indeed negligible when compared to the higher mental time; but in these tests are certain difficulties in scoring, as well as, perhaps, in the assurance of cooperativeness, that seemed to outweigh this advantage, and to favor the selection of a simpler form, as one of the addition tests, Here the necessity of a wide range of experimental material practically confined the choice to the Kraepelinian *Rechenhefte*. These contain vertical rows of the figures 1-9 in practically random order, 32 to a column, and 9 columns to a page, thus 18 to the two pages of the open *Heft*. The experimental task is to add each successive pair, i. e., the first and second digits, then the second and the third, etc. There are thus 31 additions to the column, 558 on the two pages of the open *Heft*. There are 24 pages, affording 11 double pages. There was scored the number of additions made each minute during five consecutive minutes, the total being taken to represent the efficiency of the performance. The additions were spoken aloud by the subject and followed upon a specially constructed key giving the correct answer in each case. False reactions can be noted in this way, but as they do not affect the results no account

is taken of them here; in general, the greater number of false reactions were made by the slower adders.

The other test was a modified *A*-test, consisting of 1000 of the figures 0-9, 100 of each, printed upon a space 5¾″ by 3⅜″, and so arranged that each figure occurred an equal number of times in any position. The subject is instructed to check as rapidly as possible the five zeros in each line, and the time required for this was taken to represent the efficiency of the performance. The two tests are hereinafter termed respectively the "addition test" and the "number-checking test."

A group of ten subjects underwent these tests daily, six days in the week, for a period of thirty experimental days. The subjects were nurses in McLean Hospital, five men and five women, of ages varying from 21 to 35 years. The work performed each day consisted of five minutes of addition, and on the first ten days one record of the number-checking test; while on the succeeding twenty days five records of the number-checking test were executed each day. The times of day were regularly the same for each subject. No noteworthy difference in cooperativeness was evident, but it did seem that, as indicated in a previous study, the monotony of the experiments affected the attitude of the women more than that of the men. On the other hand, it may well be that the factor of competition was stronger among the women, since, as is perhaps not unnatural, they appeared to exchange notes regarding their relative positions in the tests to a much greater extent than the men.

The results are, so far as possible, presented in the form of curves, showing the practice changes from day to day in each of the tests. Two sorts of curves are plotted for each test; those showing *absolute gains*, and those showing *relative gains*. In the case of the *absolute gains*, the standard of measurement is for the addition test, the number of additions spoken in five minutes; for the number-checking test, the standard of measurement is the number of zeros checked in one minute at the average rate maintained during the test. In the case of the *relative gains*, which are not reproduced here, the first day's performance in each test is taken to have the value of 100; and the curve is formed by the percentile values of this quantity attained in the succeeding day's practice. Here the curves are all reduced to a common denominator, and there is illustrated the proportionate amount of gain in each subject, independent of gross capacity.

The curves are presented and discussed in the following order:

Plate I, Absolute Gains in the Addition Test, Men.
II, Absolute Gains in the Addition Test, Women.
III, Absolute Gains in the Number-checking Test, Men.
IV, Absolute Gains in the Number-checking Test, Women.

The same color indicates the same subject, except as between the men and women; and the colors for the women subjects correspond to those already employed in a previous paper on practice effects in free association (this JOURNAL, vol. XXII, pp. 1-13).

Plate I, therefore, represents the absolute gains of the men in the addition test. Save in the case of ORANGE, the subjects here consistently maintained the same order of efficiency given in the initial performance. BLUE is not only the distinct leader throughout, but even draws slightly away from the nearest competitor; thus showing, in company with the greatest initial efficiency, the greatest absolute gain. While the record doubtless eliminated the initial spurt of practice, the performance of the last three days would certainly indicate that the limit of practice had not been reached. Substantially the same is to be said of the second subject, BROWN. Here the amount of absolute gain is during the earlier days of the practice, the greatest gain of all, and throughout closely approaches to that of BLUE. The limit of practice was evidently not reached. RED shows substantially the same absolute gain as BROWN, perhaps a little more, though it comes with greater slowness, and was, at the close of the experiments, apparently nearer its end. In the case of the subject with the lowest initial efficiency, GREEN, the absolute gain is least, and also slowest, saving the exceptional case of ORANGE. This subject, while commencing with an initial efficiency but slightly below that of BROWN, shows so little practice effect as to place his absolute gain quite in a class by itself for smallness, beside which those of the remaining subjects are relatively equal. The form of the curve would not indicate that the subject was near the limit of special practice, for it does not rise with exceptional slowness at the start, and, in fact, shows a relatively rapid rise at the close. In sum, it would then appear from these curves that the amount of absolute gain was for four of these subjects nearly equal, in spite of great differences in initial efficiency; the slight difference in absolute gain rather favoring those of greater initial efficiency.

The case of ORANGE apparently involves a fairly good inherent ability, with unusual insusceptibility to practice in this function.

The records also of the women as given in Plate II show some independence of initial performance and practice effect. Much the greatest absolute gain is shown by RED′, who stands third in efficiency on the initial day. The speed ultimately reached by this subject is the greatest the writer has observed in the test, and was probably not far from physiological limits imposed by the speaking of the responses. The subject had reported that she could mentally add figures ahead of where she was speaking, though in a subsequent record, where the responses were not spoken, the performance was but little in excess of that with the spoken. The next greatest absolute gain, in a performance somewhat similar to that of the corresponding color with the men, is that of BLUE′. The initial performance is the best, and the absolute gain much the greatest of the four subjects besides RED′; nor was the end of practice in sight. The subject second in initial efficiency, GREEN′, makes a very slow absolute gain, which, however, persists until it finally stands next to that of BLUE. It would evidently have progressed further. ORANGE′, who occupies a distinctly lower place in initial performance, has an absolute gain more rapid at first, which soon ceases, apparently for good, at a level definitely below that of GREEN′. The smallest absolute gain is found in the subject with the lowest initial efficiency, BROWN′. In the amount of absolute gain there is much more difference among the women than among the men, and in sum they further illustrate the same thing as was indicated by the men. The greater absolute gain may well follow the greater efficiency of initial performance; this being now associated with the striking exception of RED′, of the opposite character to that of ORANGE in the men.

Turning now to the records of the number-checking test (Plates III and IV), we find that in this function the curves of the different men subjects spread out like a fan, with the greatest absolute gain shown by the second subject, and the smallest by the subject of lowest initial efficiency. The record of BROWN dominates this plate as completely as those of BLUE and RED′ the two preceding. BROWN nearly equals the best initial performance, and its ascent is the most rapid and the furthest. The best performance, some 38 seconds for the entire blank, must lie very near the physiological limit for the test. With an initial performance a little above, GREEN shows a much inferior practice effect, though pre-

serving a definite lead over the remainder. There is still some prospect for further gain, as also in the other subjects. Though RED is throughout distinctly slower than BLUE, their absolute gains are so commingled that superiority can scarcely be assigned to either. Both gain about equally at equal rates, though BLUE is more irregular near the beginning, RED near the end. As before in the addition test, the smallest absolute gain is shown by ORANGE, who has here also the lowest level of initial efficiency. Altogether, an association of superior initial performance with greater absolute practice improvement is seen to obtain also in these records.

Unfortunately the individual differences in this test among the women subjects turn out so small that not much light on the question at issue is to be derived from the records. So far as they go, however, they do not exhibit the parallel between absolute gain and initial efficiency of which the previous records have shown such marked instances. A strikingly anomalous record is given by RED′, who, beginning at the highest initial efficiency, shows considerable drop in the practice curve, to fourth place; which is never improved upon. The absolute gain is, of course, much the smallest of any. This is the more noteworthy in connection with the very great practice effect of this subject in the addition test. The absolute gains of the other four subjects are much commingled, though BLUE′ has rather the most; in point of initial efficiency this subject stands fourth. Next come ORANGE′ and GREEN′, whose gains are practically equal, as are also their initial positions, though ORANGE′, with the slightly inferior initial position, seems to gain a little more. As in the addition test, BROWN′ shows the lowest efficiency throughout, and the smallest absolute gain with the exception of RED′; but on the whole, the greater absolute gains have not here been associated with greater efficiency of initial performance.

Nor would the number of observations be sufficient to establish a universal principle, even were they in general accord. Definite things do, however, stand out in regard to certain individual records. It is patent from such cases as BLUE and BLUE′ in the addition test and BROWN in the number-checking test, that high initial efficiency in no way precludes, but on the other hand, may frequently indicate, the expectation of considerable practice improvement. On the other hand, ORANGE and BROWN′ are examples of slight susceptibility to absolute gain, apt to be associated with lower efficiency of performance. It is not apparent that such records

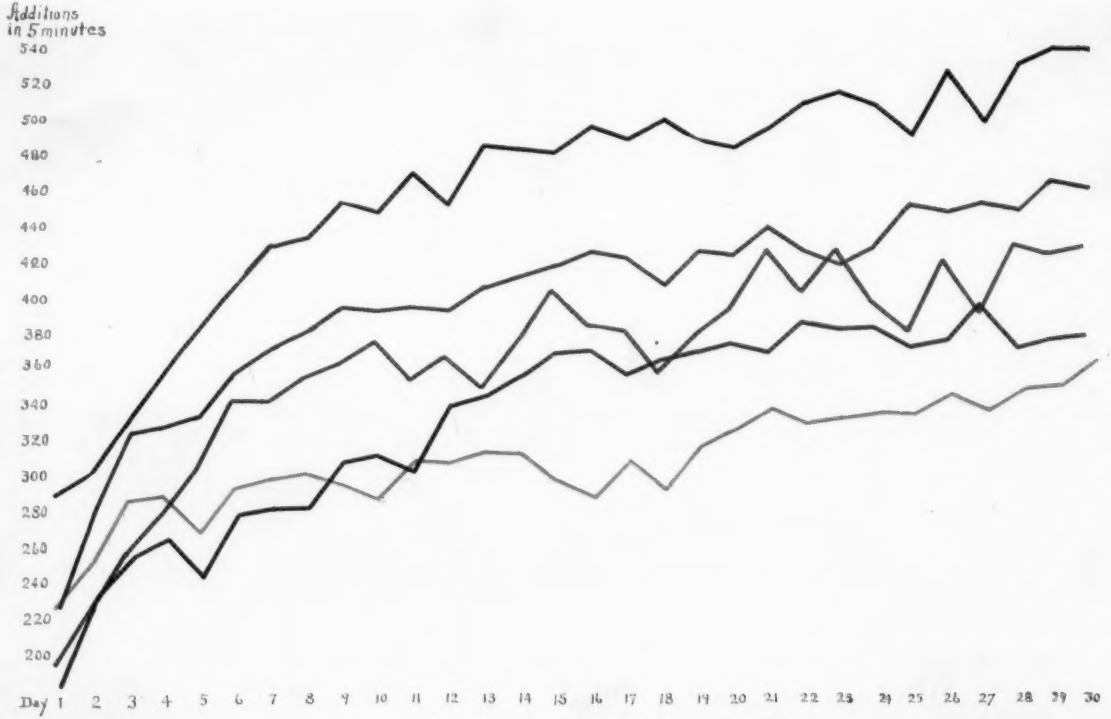

PLATE I. Absolute Gains in the Addition Test, Men.

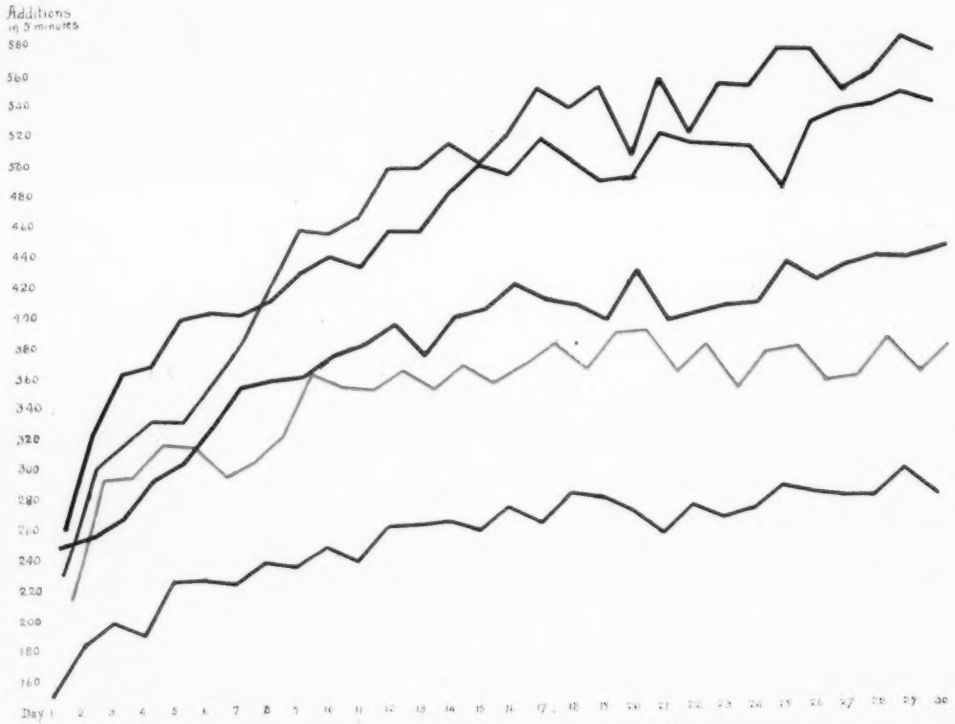

PLATE II. Absolute Gains in the Addition Test. Women.

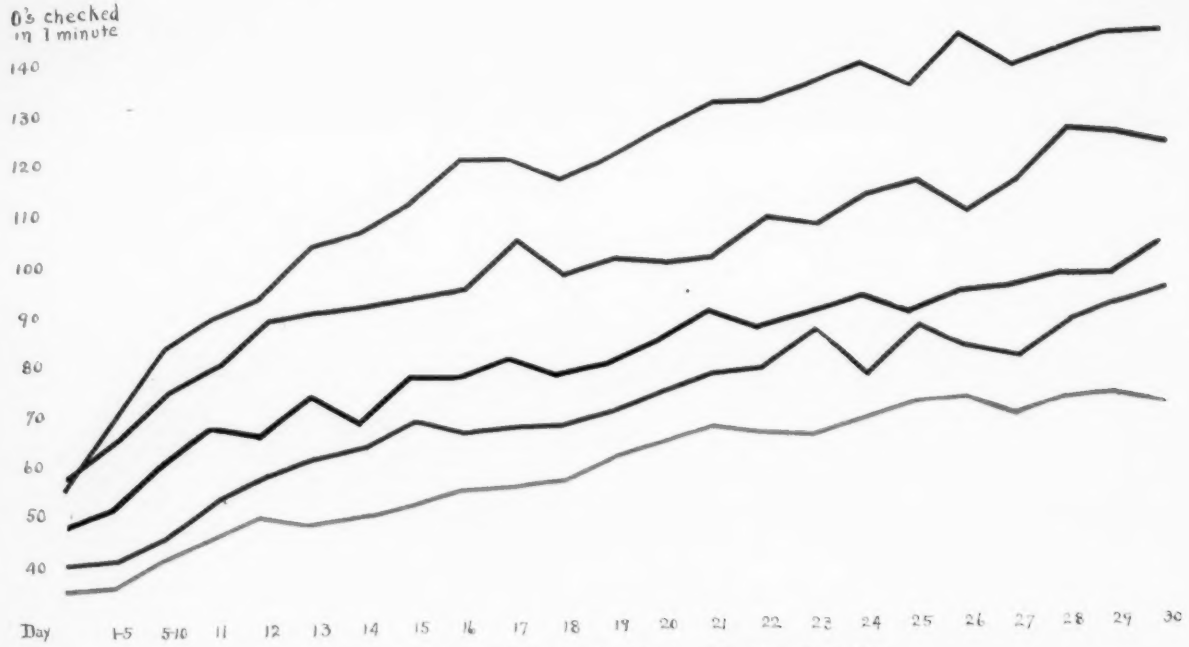

PLATE III. Absolute Gains in the Number-Checking Test, Men.

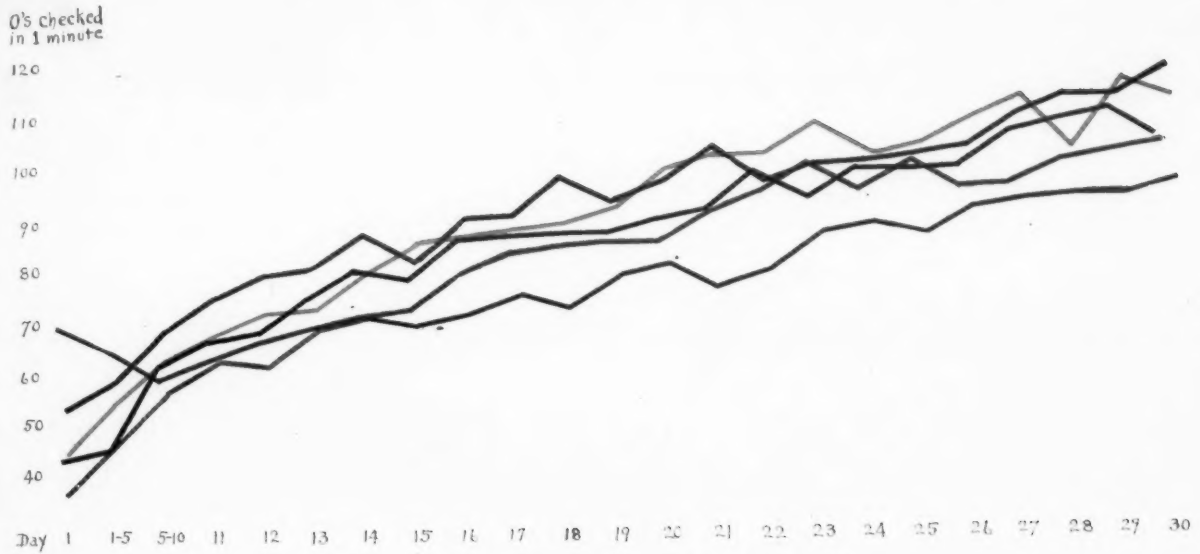

PLATE IV. Absolute Gains in the Number-Checking Test, Women.

represent the end of the practice curve for the subject concerned. We are evidently confronted, then, with cases indicating a high initial efficiency as a manifestation of superior ability to profit by practice, or plasticity; and on the other hand, with cases exhibiting a lower initial efficiency, with minor possibilities of practice improvement.

As has been explained, the curve for the relative gains reduces the results for the different subjects to a common denominator, taking the initial performance in each case as 100, and expressing the subsequent ones in their percentile relation to it. The curves in each case thus start at the same point. As would naturally be expected, the relative amounts of ascent differ largely from those in the curves for the absolute gains. Thus in the curves showing the relative gains in the addition test for men, it is seen that the greatest relative gain has been made by RED, whose regular position was third in the curves for absolute performance. This subject has reached an efficiency of some 210% of initial capacity. GREEN, somewhat slower absolutely, also does not gain so much relatively; his curve being pretty consistently below that of RED. With their high initial performances, the relative gains of BROWN and BLUE drop still further below; for they require a much greater absolute gain than the others to reach their percentile level. The relative gain of ORANGE is the smallest of all, the inferiority being more marked here than in Plate I, owing to the relatively high initial performance.

The curves showing the relative gains in the addition test for the women are dominated by the striking practice improvement of RED′. But it is noteworthy that BLUE′, who had the greatest initial efficiency, is second in point of relative, as well as in absolute gain. BROWN′, whose absolute efficiency was lowest, is next, while ORANGE′ shows a relative gain distinctly above that of GREEN′, though in absolute performance distinctly below it. GREEN′, showing the least relative gain, is third in absolute gain, second in initial performance. Here also it is seen that the relative gains tend rather to follow the reverse order of the absolute performance.

But in the case of the men in the number-checking test, it is again noticeable that BROWN, who not only had the quickest record in the number-checking test and made the greatest absolute gain in it, has with equal definiteness accomplished the greatest relative gain. The relative gains in the other records are nearly equal, which should be taken in connection with the fact that the range of these records in gross efficiency of performance is nearly 2:1. Here, then,

there is certainly no negative relation between gross performance and relative gain.

The curves are further apart in the case of the women, and show a reversed relationship to the absolute performances. They are greatest in BROWN′, whose absolute efficiency is lowest, and next in ORANGE′, BLUE′ and GREEN′, respectively. But neither in absolute nor relative gains are the individual differences especially clear-cut.

To sum up, the orders of precedence in the different functions of the two tests may be given as follows:

ADDITION TEST (MEN)

Initial Performance	Absolute Gain	Relative Gain
Blue	Blue	Red
Brown	{Brown}	Green
Orange	{Red }	Brown
Red	Green	Blue
Green	Orange	Orange

ADDITION TEST (WOMEN)

Initial Performance	Absolute Gain	Relative Gain
Blue′	Red′	Red′
Green′	Blue′	Blue′
Red′	Green′	Brown′
Orange′	Orange′	Orange′
Brown′	Brown′	Green′

NUMBER-CHECKING TEST (MEN)

Initial Performance	Absolute Gain	Relative Gain
Green	Brown	Brown
Brown	Green	Red
Blue	{Red }	{Green }
Red	{Blue}	{Orange}
Orange	Orange	Blue

NUMBER-CHECKING TEST (WOMEN)

Initial Performance	Absolute Gain	Relative Gain
Red′	Blue′	Brown′
Green′	Orange′	Orange′
Orange′	Green′	Blue′
Blue′	Brown′	Green′
Brown′	Red′	Red′

Certain limitations in the use of either absolute or relative gain as a criterion of practice effect will doubtless have

suggested themselves to the reader familiar with the properties of the practice curve. It is scarcely to be supposed that a practice improvement of n units means the same thing when added to an initial efficiency of a units as when added to an efficiency of $2a$ units. *Ohne weiteres*, however, it should scarcely be said that one is more or less than the other. If, as has been sometimes done, we simply suppose higher initial efficiency to mean that the function is nearer the end of the practice curve, then obviously the gain of n units is more difficult for the individual who has a higher initial efficiency. The present results indicate that this reasoning rests upon a very insecure foundation, for it here repeatedly appears that the gain of n units is quite as likely if not more likely to take place upon an efficiency of $2a$ than of a. Another point must be mentioned in this connection, namely, that when the function is originally measured in terms of amount performed in a given time, as it is in the addition test, the amount of work performed in practice is much greater in the case of the more efficient individuals. Thus when the less efficient A has made as many additions as the more efficient B, he may have improved as much, though taking over twice the time to do it. If this factor were of essential importance, then the low initial efficiencies should, in comparison with the other subjects, show a much greater absolute gain in the number-checking test, where they do equal work, than in the addition test, where they do less work. With the men, this is not at all the case. With the women there is perhaps a little more semblance of it, but on the whole, the number-checking test scarcely seems to have favored the practice of the poorer individuals any more than the addition test. This, with its implication of a law of diminishing returns from individual practice series, leads into the great series of problems regarding the most efficient way to practise. A definite amount of work doubtless produces different practice effects according to different apportionments to the same individual, just as it illustrates different practice effects when, as here, it is similarly apportioned to different individuals.

According to presentation in terms of time or amount, the phenomena of the absolute gain present a curious dilemma. The curves have been plotted in terms of amount performed in a given time, and if the absolute gains of the more efficient individuals are greater than those of the less, the records assume the fan-shape recorded most perfectly in Plate II, the distances between the subjects becoming greater. Now if, instead, the curves were plotted in terms of time, they would

approach each other as they neared the lower limit of quickness, and the distances between the subjects would become less. Compare the cases of a worker, C, making 100 artificial flowers per hour, and one, D, who makes 50 in the same period. With given practice, C becomes able to make 175 per hour, and D able to make 100. The gains compare as follows according to the way they are considered:

C has made an absolute gain of 75 pieces.
D has made an absolute gain of 50 pieces.
C has made a relative gain of 75 per cent.
D has made a relative gain of 100 per cent.
C has decreased the time required for 100 pieces by 26 minutes.
D has decreased the time required for 100 pieces by 60 minutes.

Nevertheless, there can be but little doubt that any manufacturer would consider C as having improved the original lead over D. If for artificial flowers we substitute distance covered in yards, C would certainly be a further distance ahead of D at the second timing than at the first; nor according to the observed properties of the practice curve, would C's lead be likely ever to become less.

And further, since the ratio of gain is not constant in the practice curve, but tends to decrease, the relative gain cannot itself be employed as a criterion of practice effect, though it is similar, whether time or amount is taken as the unit of measurement. If one considers equal percentile changes, no matter what their bases, to represent equal practice effects, one runs counter to our most fundamental conceptions of the nature of the practice curve. One can scarcely require that a function of 600 units shall show 300 units of improvement before it shall be judged to have improved equally to an increase of 50 units from a basis in another individual of 100 units. If a function, x, begins at 600 units and increases to 900, it should certainly be accounted more plastic than an identical function, y, which begins at 100 and in the same time increases to but 150. It is another question whether y should be accounted more plastic than z, which begins at 500 units and rises under the given conditions to 550. If y reaches the 500 mark it will not, presumably, be able to reach 550 as quickly as it did 150 from the 100 mark, therefore, not so quickly as z increased from 500 to 550. On the other hand, y has already increased in capacity by 50%, which z is not likely ever to do now. It would depend upon whether z's advanced position were

to be regarded as constitutional, or due to an advanced position in the practice curve. If the constitutional ability of *z* began at or near that of *y*, it must be reckoned as more plastic; if it is fairly represented by the 500 unit mark, it is obviously less so.

But of course we cannot know objectively, from any isolated or initial performance, what part of the function's practice curve it represents. This we must know, to judge of the amount of plasticity represented by a given practice gain. From the form of the actual practice curves we must judge whether there are sufficient differences in the stages of practice to modify the interpretations of the gains accordingly. Except where such differences are indicated, and they scarcely seem to be in the present results, there would seem to be two criteria of greater plasticity. First, a greater absolute gain, in terms of amount, upon a basis of greater initial performance. Secondly, a greater relative gain leading to a greater efficiency of terminal performance.

According to these criteria, the records show various instances of individual differences in capacity apparently the result of differences in the fundamental plasticity of the function. The inferior showing of ORANGE in the number-checking test, for example, is essentially due to something other than mere lack of practice, for in such a case the relative gains would but have been so much the greater, as they were in RED′ for the addition test. On the other hand, the performance of BLUE′ in the addition test is not a matter of starting nearer the end of the practice curve, for not only has she a better initial performance, but gains more, both absolutely and relatively, than BROWN′, ORANGE′ or GREEN′. Her superior initial performance is to be looked upon rather as a matter of fundamentally superior aptitude in the function,[1] which continues to manifest itself in greater practice improvement. The same is to be said of the record of BROWN in the number-checking test. The superior aptitude expresses itself in both superior actual performance and superior ability to profit by practice. Or when the record of ORANGE in the addition test is compared with that of BLUE, it is seen that ORANGE starts not only distinctly below the absolute level of BLUE, but fails to gain absolutely or even relatively as much. Here the function in ORANGE is certainly less plastic.

Ultimately that individual is the most plastic who is able

[1] In this connection, the reader may be reminded of the especially good adaptation of this subject in the free association test. Am. J. of Psych. XXII, Plate facing p. 2.

to improve the most. If we may reckon the original ability in the function as approximating zero, as it may be considered to do at birth, then the individual who stood higher at the beginning of special practice would be the individual who had, up to that time, improved more. This previous improvement might carry with it less, might carry with it greater prospect of future improvement; the present experiments seem to indicate that it carries with it the prospect of greater future improvement more frequently than less. But the different exceptions show that we ought in no wise to consider the plasticity of a function as always the determining factor in its efficiency at the beginning of special practice; the case of ORANGE in the addition test may be quoted in illustration. It thus seems likely that certain factors of neural constitution, independent of plasticity, may determine high or low efficiency at the beginning of special practice. This is what is meant by the "constitutional" factors in ability as cited above; and though undeniably complicating the situation, they seem a necessary postulate to its proper formulation.

We have then, finally, (1) a difference in the individual's (*resp.* function's) fundamental plasticity, i. e., ability to profit by practice, (2) a difference in the actual amount of practice experienced, and (3) constitutional factors, independent of plasticity, in the nervous system. The inquiry has been concerned with the relative importance of these factors in producing the individual differences seen at the beginning of special practice. In the present instances, their influences would seem to operate in about the order named.

Further points of inquiry concern the results as they illustrate other important properties of the ability to improve by practice. To what extent does it seem to be a fundamental attribute of the individual, or distributed independently among various special functions? The performance of RED′ is an illustration of extreme plasticity in one test combined with an equally striking lack of it in the other. The gain of BROWN in the number-checking test is quite out of proportion to that in the addition test. On the other hand, ORANGE and BROWN′ seem to furnish instances of a lack of plasticity in both tests; for BROWN′, though making the greatest relative gain in the number-checking test, in neither case gains sufficiently to leave a fairly definite lowest place. How far such a presence or lack of plasticity might be general, the experiments, of course, do not indicate; but it seems quite certain that the degree of plasticity is sometimes determined with regard to the special function.

An additional point concerns the daily fluctuations in the practice curves after they have ceased their uniform rise. Like other practice curves, the daily records in both tests are serrated; going now up. now down. The causes of such episodes in the curve might be general, affecting the whole organism, or confined to the particular functions involved. Some estimate of the extent to which general or special causes are involved might be derived through comparing the curves of the two tests, noting whether there tended to be a coincidence of marked cusps in the curves.

The testimony of the curves in this regard is quite unequivocal. If one superposes the two curves of each subject for the last twenty days of performance, it is evident that the curves rise and fall with practical independence of each other. Extreme rises or falls in one may be accompanied by rises, falls or no change in the other function. This is interesting in connection with the fact that such introspective data as were given seemed to be equally independent of the performance in either test; nor did the subjective estimate of efficiency always accord with that actually attained. The performance in the two tests would seem to be determined by factors largely outside the scope of introspection; and the organic processes giving rise to a feeling of unfitness for the task must be of considerable intensity to show an actually unfavorable effect upon its performance. While it is not necessarily true that a general change in bodily condition would affect both tests in the same direction, yet the comparative independence of their fluctuations makes it extremely probable that different factors of bodily condition are operative upon them, and throws an interesting side-light upon the complexity of the factors affecting the performance in two by no means unrelated experiments.

The groups of subjects are perhaps too small to expect any special sex differences to be illustrated. Even though consistent differences between such groups appear, they may often be the result of chance. In the addition test the performance of the women is much more variable than that of the men, in the number-checking test it is much less so. In neither case is there much difference in the average performance. More significant perhaps is the question of a sex difference in susceptibility to practice. In the addition test the balance is about equal; and in the number-checking test, the variability of the records makes any generalization hazardous. A far-reaching sex-difference in susceptibility to practice seems, so far as concerns the functions covered by these experiments, quite improbable.

The secondary findings in these experiments may then be enumerated as (1) the specific character of efficiency in the tests themselves, (2) the specific character of plasticity in them, (3) the specific character of such episodic changes in the organism as influence their efficiency, and (4) the absence of any notable sex-difference throughout.

The more significant result would seem to be the indication that a superior performance at the beginning of special practice is not necessarily, nor even probably, attained at the sacrifice of prospects for future improvement. A high initial efficiency may carry with it as much or more prospect of improvement under special practice than a low one. It was not because the favored individual had had more of the general experience enabling him to meet the experimental situation better, but because he possssed the native ability to profit more by such experience, general and special, past and future. Not practice, but *practiceability,* is responsible for the superior position of such an individual; and, in broader aspect, not education, but educability.

The present results seem then to be another drop in the current that sets towards the interpretation of vital reactions as primarily limited and determined by factors of original nature, upon which a more incidental coloring is imposed by those of experience and environment.

THE INFLUENCE OF CAFFEIN ALKALOID ON THE QUALITY AND AMOUNT OF SLEEP

By H. L. Hollingworth, Columbia University

The data presented here were accumulated during an elaborate series of experiments undertaken with the following five chief purposes in mind.

1. To determine both qualitatively and quantitatively the effect of caffein on a wide range of mental and motor processes by studying the performance of a considerable number of individuals for a long period of time under controlled conditions.

2. To study the way in which this influence is modified by such factors as the age, sex, weight, idiosyncrasy and previous caffein habits of the subjects, and the degree to which it depends on the amount of the dose and the time and conditions of its administration.

3. To investigate the influence of caffein on the general health, on the quality and amount of sleep, and on the food habits of the individuals tested.

4. To inquire into the value and adaptability of a considerable array of simple tests, with a view to their standardization for the purposes of pharmaco-dynamic research.

5. To accumulate data on the effects of practice, fatigue, diurnal variations in efficiency, the physiological limit, individual and sex differences, and various other allied topics growing out of such an extended series of tests on a large number of subjects.

Plan and Procedure

In order to reduce to a minimum distractions and disturbances to which such experiments are usually subjected and to provide for the greatest convenience of the experimenters and the comfort of the subjects, a well lighted and ventilated six-room apartment on the ground floor of a building in a quiet part of the city was equipped as a special laboratory. Sixteen subjects, ten men and six women, were engaged for full time for a period of 40 days, and were required to appear at the laboratory at stated times during the day or

to remain there permanently, as the case might be, and submit themselves to the series of mental and motor tests. These subjects were to abstain from the use of all forms of caffein (coffee, tea, chocolate, cocoa), alcohol, nicotine and all other drugs, as well as from soda fountain drinks containing patent syrups, except in so far as these drugs were prescribed by the director or by the medical assistant. They were also to observe regular hours of eating and sleeping, and to report any unavoidable irregularities in these matters. These conditions were complied with throughout the experiment.

The present study is a report on the second point of the third chief topic. Reports on other topics are ready for publication, and may be expected to appear soon in accessible sources.

The Influence of Caffein on Sleep

Throughout the experiment each subject kept daily records of his general condition of health and spirits throughout the day, indicating in his special "daily health book" any signs of bodily distress or discomfort, such special or general organic, digestive and nervous disturbances as might be noted from time to time, and in general as good an introspective account as possible of his mood and tonus. In addition to stating the character of any symptoms or unusual observations, the time of their appearance and their duration were noted and reference made to any outside factor which might have been responsible for the condition described. This health record was divided into two parts, the first having to do with the day-time hours preceding the evening on which the entry was made, and the second having to do with the night-hours following. This second entry was made on the following morning, immediately on arrival at the laboratory. At this time each individual recorded the approximate number of hours which he had slept during the night and described the quality of his sleep as "better than usual," "ordinary," or "worse than usual." In working up these data the approximate number of hours was accepted as stated. From the point of view of character or quality, an attempt was also made to express the effect of caffein in numerical form. Representing the individual's *usual* quality of sleep by a value of 200; letting the value 100 indicate sleep which, according to the judgment of the individual himself, was *better than usual;* and letting the value 300 represent the quality of sleep which the individual himself judged to be *worse than usual,* tables were compiled from the introspective records

occurring in the daily health books. In the individual averages then as well as in the squad averages, a value of 200 indicates normal sleep; all values less than 200 indicate sleep judged unusually good; while all values larger than 200 indicate impaired sleep.

It will be recognized at once that these measures of sleep quality are only rough and approximate, but it is just as obvious that they are as accurate measurements of the thing in question as can well be secured. The individual himself is the only one who knows anything about his customary sleep quality. In daily life we pass such judgments as those given in the present experiment, and in much the same way, with about the same number of categories. We pronounce ourselves to have slept "well" or "poorly" or "about as usual." Finer distinctions would probably have little or at most exceedingly variable meaning. With respect to the criteria on which such judgments are based there are also considerable individual differences. The number of hours slept through, the number and character of the dreams, the interval after retiring before sleep ensued, the number of times awakened during the night, general feelings of relief or languor after arising, etc., all play their part, no doubt. And the judgment is at best only a secondary one,—that is to say, the quality of sleep is inferred from introspections and observations made during waking moments. In spite of this, few judgments of this subjective character would seem to have higher reliability than the individual's own opinion of the satisfactoriness of his slumber, and when the categories are limited to the three employed here, the judgments are delivered with a high degree of confidence. The reliability of the judgments is moreover emphasized by the consistent conclusions suggested by the various tables.

The statements of number of hours' sleep are at best only approximate, in cases of impaired sleep. When the slumber was not disturbed the figures are more reliable, since all the subjects observed regular hours of retiring and arising. It will not be possible here to compare the individual subjects nor the squad averages with each other, except in so far as the number of hours' sleep on control days is adopted as the normal in each case. A fairly constant average of about 7.5 hours' sleep appears to be the normal for all of the subjects, as is indicated by the records for the week before the caffein doses began, and also by the records for the control days during the caffein experiments.

The records on sleep fall into two general sections, the

first covering 28 days of caffein alkaloid experiments, and the second covering 7 days of experiments with syrups and carbonated water, with and without caffein contents. In the following tables the first column gives the averages for the first week, during which only sugar doses were given to all subjects. The second column gives the averages for the control days during the following three weeks. These two columns may then both be considered as normals. The third column gives the averages for the days on which the dose was either 1 or 2 gr. of caffein, the fourth column the records for the 3 to 4 grain doses, and the fifth column for the 6 gr. doses. The last column gives the final average for all the caffein days (1 to 6 gr. doses). The individual subjects are grouped in squads according to the time at which the dose was taken and according to the distribution of the doses during the month.

Squad I, consisting of subjects 1, 4, 7, and 15, were the control squad, and ran throughout the four weeks on sugar doses only. Nevertheless their records have been averaged as though they had taken the caffein on alternating days, as was the case with squads III and IV. The parenthesis around their averages indicates then that these were not really caffein days, but days on which the caffein squads took the doses indicated at the top of the various columns. The sleep records of the individuals taking caffein may thus be compared with the control records of individuals taking only sugar on the corresponding days. The caffein records are thus trebly checked up,—first by a normal week for all subjects, second by control days for all subjects during the following three weeks, and thirdly by a control squad running throughout the month on sugar doses only.

Squad II, consisting of subjects 8, 12 and 13, took caffein on three days and sugar on the following three days at 10:30 A. M., followed in turn by three days of caffein, and so on throughout the experiment, except that there was only one day available for the 6 grain dose. The 1 to 2 grain records for this squad are the averages of 3 days of 1 grain and 3 days of 2 grain doses. The records for 3 to 4 grains are the averages of three 4 grain days, while the records for 6 grains are not averages but single records.

Squad III took caffein and sugar doses on alternate days throughout the experiment, at the 1 o'clock lunch hour, thus giving two days for each of the 1, 2, 3, 4 and 6 grain doses. Squad IV also alternated caffein with sugar doses throughout

the month, with the same distribution of days as in the case of squad III, the only difference being that the dose was taken in the middle of the afternoon instead of at the lunch hour. Squad III consisted of subjects 3, 9 and 14, while squad IV contained subjects 5, 6, 10, 11 and 16.

Experiments with Caffein Alkaloid

Table I gives the individual averages for quality of sleep during the first four weeks, and also the squad averages, with final averages for the caffein days and a grand average for each column for the three caffein squads.

TABLE I. INFLUENCE OF CAFFEIN ALKALOID ON THE QUALITY OF SLEEP

				CAFFEIN DOSES			
Squad.	*Subjects*	*First Week*	*Control Days*	1 to 2 gr.	3 to 4 gr.	6 gr.	*Caffein Average*
I	1	180	190	(225)	(200)	(150)	(200)
Sugar only	4	200	230	(200)	(200)	(300)	(220)
	7	170	150	(175)	(125)	(100)	(140)
	15	200	230	(225)	(200)	(250)	(220)
Average.....		187	200	(206)	(181)	(200)	(195)
II							
Morning	8	220	220	250	266	300	273
	12	200	210	200	200	300	233
Caffein 3 days	13	220	190	200	200	200	200
Sugar 3 days							
Average.....		213	207	216	220	266	234
	3	200	240	275	200	200	225
III	9	220	190	225	200	250	225
With lunch	14	200	230	200	175	200	191
Alternately							
Average.....		213	220	233	192	217	214
	5	230	200	250	250	300	266
	6	200	190	175	175	250	200
IV	10	220	210	175	225	300	233
Mid P. M.	11	200	210	250	250	200	233
Alternately	16	150	140	150	150	300	200
Average.....		200	190	200	210	270	226
Grand averages of Squads II, III and IV.....		208	206	216	207	251	224

Table II brings together the averages for each squad, at the same time giving the mean variation of each average and the number of cases from which the average is in each case derived. The table also gives the final averages for the three caffein squads, the mean variation of the three squad averages from this final average, and the total number of cases for each kind of dose. The number of cases depends chiefly on the number of individuals making up the squad,

and in the case of squad II on the fact that 3 grain doses were not administered and that only one 6 grain dose was given.

TABLE II. THE SQUAD AVERAGES FOR CAFFEIN ALKALOID

Squad	*First Week*	*Control Days*	*1 to 2 gr.*	*3 to 4 gr.*	*6 gr.*
I	Av.....187	200	(206)	(181)	...
Sugar only	M. V..... 47	35	35	30	...
	Cases.... 24	28	16	16	...
II					
Caffein 3 days	Av.....213	207	216	220	266
Sugar 3 days	M. V.....40	31	27	33	44
10.30 A. M.	Cases.... 18	30	18	9	3
III	Av.....213	220	233	192	217
With lunch on	M. V..... 31	40	50	15	72
alternate days	Cases.... 18	30	12	12	6
IV	Av.....200	190	200	210	270
mid P. M.	M. V..... 33	49	50	36	39
alternate days	Cases.... 30	50	20	20	9
Final Averages	Av.....208	206	216	207	251
of caffein	M. V.... 6	10	11	10	23
squads	Total cases... 66	110	50	41	18

The data presented in the two preceding tables seem to justify the following conclusions concerning the influence of caffein alkaloid, taken in its pure form, on the quality of sleep.

1. Doses smaller than 6 grains do not cause impairment of sleep, so far as the squad averages indicate. The average M. V. of these squad averages is 38. Although the figures for squad II are larger for all doses of caffein the range is quite within the probable error except for the 6 grain doses where sleeplessness is clearly present (Table II). Squad III shows no sleep impairment whatever, the quality being reported even quite uniformly better on caffein days. Squad IV similarly shows no deterioration in sleep quality until the 6 grain dose is reached, but the falling off at this point (270) is apparent. The final averages of the caffein squads show the rule clearly. Up to the 4 grain doses the sleep quality remains quite constantly about 209, but at 6 grains there is an abrupt falling off to 251 (Table II). Since these figures are the averages of 11 individuals, with daily records covering a period of 28 days, they have high reliability.

2. The influence of the caffein dose depends to a quite appreciable degree on the conditions under which the dose is taken, and especially on the time of day, the contents of the stomach at the time, and the frequency with which the dose is taken. This dependence is indicated by a comparison of the averages for squads II, III and IV.

a. The greatest impairment of sleep quality is found in the case of those taking the doses on successive days (Av. 234), and this is true in spite of the fact that the dose was in these cases taken early in the morning, some four hours before squad IV and two to two-and-a-half hours before squad III. Had the dose been taken later in the day the difference would doubtless have been still greater. It is impossible to say, on the basis of the data at hand, how soon this cumulative effect would be compensated by such processes of adaptation as are well recognized features of drug action.

b. Next to this squad, the greatest sleep impairment is found with the group (Squad IV) taking the caffein dose late in the afternoon, between meals and on an empty stomach (Av. 226).

c. Quite in line with this fact is the further evidence that when the dose is taken along with food substance, as in the case of squad III who took the caffein at the lunch hour, there is absolutely no evidence of sleeplessness. The presence of food substance in the stomach seems not only to retard the action of the drug but to weaken or even completely neutralize its effect, so that the average for squad III (214) is actually better than their own average on control days (220), although this difference, since it is quite within the probable error, is not evidence of genuine superior quality. The lowest value for this squad is at the 1-2 grain doses (233) but this large figure is due solely to the one individual (subject 3, Table I) who reported poor sleep for several nights in succession,—on control days (240) as well as on caffein days.

3. These results are confirmed by a more detailed study of the records of the individuals making up the various squads. Three subjects, 3, 13 and 14 are not affected even by the maximal 6 grain dose. Five remain unaffected until the 6 grain dose is reached, these being subjects 6, 9, 10, 12 and 16. Only three individuals of the total eleven show signs of disturbance before the 6 grain dose is reached,—these being 5 and 8 (who report sleeplessness as soon as the caffein doses begin and show increasing impairment with larger doses) and 11 who reports 250 for 1-2 and for 3-4 grains but did not seem to be disturbed by the 6 grains.

4. The age of the individual, within the limits here reported, —21 to 39 yrs.,—does not seem to influence his susceptibility to the sleep-disturbing effects of caffein. The three individuals who report poor sleep after the minimal doses are 24, 27 and 33 years of age, respectively, averaging 28 years.

The five who were disturbed only by the 6 grains range from 21 to 33 years, averaging 26. The three who are not affected at all are 22, 27 and 39 years old, averaging 29.3 years. The figures thus show no correlation between age and the ease or degree of sleep-disturbance. (See Table III.)

5. Previous caffein habits do not seem to modify the individuals' susceptibility during the experiment. Table III indicates for each subject the coffee or tea drinking habits indulged in before the experiments began, and reveals no uniformity. Individuals who were accustomed to the regular use of caffein-containing beverages are to be found in each group along with those who have never used coffee nor tea, or have used them only occasionally.

6. So far as the present experiment is concerned, no sex differences in susceptibility are disclosed. Four of the subjects in the caffein squads were women. Of these two were affected by minimal doses, one by maximal doses only, and one not at all. Of the men, two were not affected at all, four were affected by the maximal dose only, and one by the minimal.

7. The only factor which correlates closely with susceptibility is weight. Table III shows this correlation clearly. The average weight of those who are affected by the minimal doses is only 120 pounds. The average weight of those who are affected, but only by the maximal dose, is 149 pounds, while the average weight of the three individuals who are not affected at all is 176 pounds. That is to say,—the greater the body weight of the individual the greater the immunity to the sleep-disturbing influence of caffein. The two slightest subjects, 5 and 11, are in the susceptible group, while the heaviest woman and the two heaviest men are in the immune group. The relation between body-weight and the action of drugs in a medicinal way is a well-recognized principle of pharmacology; and it is interesting to find such close confirmation of the principle in these introspective sleep records. It means simply that, when a fixed dose is administered, the heavy or large individual receives relatively a smaller dose per unit of tissue, and the influence of the drug is correspondingly reduced. Age and sex differences in susceptibility to drugs are probably in many cases not true age or sex differences, but differences based on variations in weight or size. A given amount of caffein, for instance, should be expected to produce greater sleep disturbances in a child than in an adult, not so much because of the child's immaturity as

because of the fact that he receives a larger dose per unit of tissue.

Table III presents the classification of the eleven caffein subjects according to their susceptibility, giving at the same time their age, weight and caffein habit.

TABLE III. INDIVIDUAL DIFFERENCES IN SUSCEPTIBILITY

Type	*Subject*	*Age*	*Weight*	*Caffein Habits*
1. Reacted to minimal Doses	8	24	144	Used regularly
	5	33	105	Used regularly
	11	27	110	Abstainer
Average.....		28	120	
2. Reacted to maximum doses only	12	24	160	Used regularly
	9	21	130	Abstainer
	6	33	125	Used regularly
	10	28	157	Occasionally
	16	24	174	Used regularly
Average.....		26	140	
3. No reaction	13	22	175	Used regularly
	3	39	159	Abstainer
	14	27	193	Occasionally
Average.....		29.3	176	

TABLE IV. EFFECT OF CAFFEIN ON AMOUNT OF SLEEP

Squad	*1st Week*	*Control*	*1 to 2 gr.*	*3 to 4 gr.*	*6 gr.*	*Caffein Average*
I. Sugar only.....	7.45	7.40	(7.50)	(7.75)	(7.67)	(7.55)
II. Three day periods.	7.13	7.63	7.46	7.57	7.07	7.37
III. With lunch.....	7.43	7.47	7.57	7.33	6.40	6.90
IV. Mid P. M.....	7.20	7.46	7.38	7.00	6.30	6.88
Average of Squads II, III and IV—Caffein....	7.25	7.52	7.47	7.30	6.50	7.05

Table IV gives the squad averages of the approximate number of hours' sleep, as well as the final average for the three caffein squads. The figures indicate hours and decimal parts of an hour. The indications here thoroughly bear out the conclusions based on the judgments of sleep quality. The control squad (I) shows little variation as the experiment proceeds, the average amount of sleep being uniformly about 7.5 hours. Squad II, taking caffein in the morning, proceeds in much the same way until the 6 grain dose is given, when the time drops to about 7 hours,—a loss of half an hour sleep. The amount of sleep for squad III, taking dose with lunch, does not diminish appreciably until the 6 grain dose is given, when the earlier average of 7.4 hours abruptly drops to 6.4 hours,—a loss of one hour. The figures for squad IV, taking dose in the afternoon, between meals, drops off .5 hour at the 3 to 4 grain doses, and still another .5

hour at the 6 grain dose. Comparing the caffein average with the control average, squads III and IV lose on the whole, for 1 to 6 grain doses, .6 of an hour. While squad II averages, for the whole range of doses, a loss of only .3 of an hour. The grand average of the caffein squads shows a slight tendency to fall off for the small doses, with an abrupt loss of .7 of an hour at the 6 grain dose; while the grand average for the total range of doses (1 to 6 grains) shows a loss of half an hour, the figure falling from 7.5 hours on control days to 7.0 hours. The individual records show nothing new, and are consequently not published here.

Influence of Syrups, with and without Caffein, on the Quality of Sleep

This experiment covered one week. On two days, no dose at all was given; and on two days, soda fountain syrup containing no caffein was served with carbonated water. On the remaining three days, which were, however, scattered throughout the week, varying amounts of the syrup were given, served with the carbonated water as before, but containing caffein alkaloid (1.2 grains per glass). On one day, 1 glass was taken; on another, 3 glasses; and on the third day, 5 glasses. In all cases the drink was taken in the middle of the afternoon. When the large amounts were taken the drinks were distributed over a period of 2 or 2.5 hours. When the small amounts were taken, the three o'clock hour was chosen for the drink. In this experiment, 12 subjects were used, all of whom had taken part in the previous experiment. No squad division was made. The days on which no dose was taken (called "blank days" in the table), served as control days for the whole group.

Representing as before, the *normal* quality of sleep by the value 200, letting 100 represent sleep introspectively judged as *better than usual,* and 300 sleep judged as *worse than usual,* the following table results from the week's experiment on the 12 subjects. The figure for "blank days" is thus an average of 12 records on each of 2 days,—an average of 24 cases. The figure for "syrup days" is an average, in the same

TABLE V. INFLUENCE OF SYRUPS, WITH AND WITHOUT CAFFEIN.

Character of the dose	SLEEP QUALITY *Average*	*M. V.*	HOURS SLEEP *Average*
Blank days	170	54	7.48
Plain syrup, with carbonated water	208	23	7.69
Syrup, with caffein—			
1 glass (1.2 gr.)	180	30	7.42
3 glasses (3.6 gr.)	209	49	7.16
5 glasses (6.0 gr.)	250	60	6.75
Syrup, with caffein, average	213	46	7.11

way, of 24 cases; while each of the "caffein" figures is an average of 12 records.

The results of this experiment completely confirm the conclusions presented in the first section. The "blank days" have a good average quality (179), but no better than that for the day on which the dose consisted of one glass of syrup containing 1.2 grains of caffein. The 3.6 grain dose of caffein results in a poorer quality of sleep than that on the "blank days," but no poorer than that reported on the days on which the same amount of plain syrup was taken (3.6 gr. caffein, 209; plain syrup, 208). Moreover both these figures are approximately ordinary sleep (200). But on the days on which the drink contained 6 grains of caffein there is clear evidence of sleep impairment (250). This is just the point at which the doses of pure caffein alkaloid produced marked signs of sleep disturbance. The average for the three caffein days (1 to 6 gr.) is poorer than that for the plain syrup days (caffein 213, syrup 208), while the average for "blank days" is better than either of these two (179).

The reports of approximate amount of sleep point in the same direction. The "blank days," the plain syrup days and the 1.2 gr. caffein day all yield the well-established normal of about 7.5 hours of sleep. The average after the 3.6 gr. caffein dose appears to be only slightly less, being 7.16, a loss of about .25 hour. But after the 6 grain dose there is an abrupt falling off, the average being only 6.75 hours, a loss of .75 hour as compared with the normal amount. Not only in their relative amounts, but in absolute magnitude as well, the figures for sleep quality and for amount of sleep, in this second section, correspond closely to the figures yielded by the experiments reported in the preceding section on the effects of pure caffein doses.

It should be remarked that in no case did the subjects know the nature of the dose which they were taking at the time. The only indications they had throughout the experiment were based on the after-effects of the drug. In *Section 1*, each subject received a capsule daily, this capsule sometimes containing caffein in amount known only to the director of the experiment, and at other times only sugar of milk. The control capsules were varied in size, as were, of necessity, the caffein capsules. In *Section 2*, the subjects knew only that they were taking soda-fountain drinks. There was said to be a slight variation in the taste from time to time; but this was supposed, by the subjects, to be due to the degree to which the syrup had been mixed with the carbonated water,

to its temperature, etc. The disturbing factors of suggestion, interest, excitement and unequal introspective attention were thus effectually avoided.

Summary

By way of summary we may say,—Small doses of caffein alkaloid (1 to 4 grains), taken either in the pure form or accompanied by small amounts of syrup, do not produce appreciable sleep disturbance except in a few individual cases. Doses larger than these (6 grains, in the present experiment), induce marked sleep impairment with most subjects, though even here a few individuals show complete resistance to its effects. The effects are greatest when the dose is taken on an empty stomach or without food substance, and when it is taken on successive days, so as to permit of cumulative effect. The effect of the drug does not seem to depend on the age, sex, or previous caffein habits of the individual, but varies inversely with increase in body weight. These conclusions hold both for the quality and for the amount of sleep.

MINOR STUDIES FROM THE PSYCHOLOGICAL LABORATORY OF VASSAR COLLEGE

XVIII. Mediate Associations Studied by the Method of Inhibiting Associations: An Instance of the Effect of *"Aufgabe"*

By M. Valerie Atherton and M. F. Washburn

The term "mediate association" is one whose meaning seems to be differently apprehended by different writers. Titchener, in his recently published Textbook of Psychology, writes as follows: "Some psychologists believe that an association may be set up, originated, by unconscious (purely physiological) intermediaries. I examine a picture, we will say, which the artist has signed; my eyes travel over the signature, but I fail entirely to remark it. At some later time I am examining another picture, signed in the same way by the same artist; again my eyes travel over the signature, but again I fail to remark it. Nevertheless, the second picture suggests the first; the signature has impressed my brain, although it has not aroused a perception; the ideas of the two pictures are connected by this unconscious link. Here is a case of mediate association." This form of association Titchener thinks does not occur: "association requires attention." (*Op. cit. p.* 386).

Evidently what Titchener understands by mediate association is a case where the link (the artist's signature) which connects the two experiences (the two pictures) has never, *at any time*, been in focal consciousnss. The observer failed altogether to remark the artist's signature when it was originally presented to his sense of sight. Now an examination of the methods used by some of the investigators of mediate association will show that they could not possibly have understood the term in this sense. When Münsterberg,[1] for instance, presented two different words on two different occasions, with the same nonsense syllable accompanying them, in order to see whether the second word would suggest the first, he surely did not expect that the observer would not notice the nonsense syllable at all on either occasion. When Cordes[2] gave as the common *Nebenreiz* accompanying two words a tone, a perfume, or a weak electrical stimulus, he certainly did not suppose that the *Nebenreiz* would be unperceived or unattended to: he meant only to find whether it could constitute a link between the two words without being recognized as such. When Aschaffenburg[3] quotes as illustrations of the mediate associations he encountered in his experiments, such cases as the following: "Schnitt (Schlitten), Fahrt; Allmacht (alma). Mater," he did not for a moment think that the intermediate links

[1] H. Münsterberg: *Studien zur Associationslehre*, Beiträge zur Exp. Psychologie, I. 1893 (Heft 4), 1-39.
[2] G. Cordes: *Experimentelle Untersuchungen über Associationen*, Phil. Stud. XVII. 1901, 30.
[3] G. Aschaffenburg: *Experimentelle Studien über Associationen*, Psychol. Arbeiten (Kraepelin), I. 1896, 209-299.

had never in the past been consciously associated and attended to. A fair question with regard to the process of association is this: may process A suggest process B, both of them being conscious processes, by means of an intermediate process, C, which is not a conscious process at all, but exists only on the physiological level at the time when it functions to connect A and B, though it may quite well have been accompanied by consciousness on previous occasions?

As an example of the kind of mental event to which we would apply the term "mediate association," we may give the following: The observer was instructed on hearing a stimulus word to respond with a word which should be wholly unassociated with it. The stimulus word was "cane." It started immediately in the observer's mind the verbal series "sugar—south." This was interrupted by the remembrance of the instruction not to give associated words. The word "storm" then came, purely as an auditory-motor word. After it had been given, there developed in the observer's mind the memory idea, chiefly visual, of uprooted trees and signs of devastation by a storm, seen from a car window on a recent journey to the southward. That this memory had not been in consciousness at all during the interval between stimulus and reaction word the observer, who had had long practice in introspection, was sure.

The occurrence of associations whose mediation does not come into consciousness in any recognizable manner is certainly an interesting and well-attested phenomenon. We have undertaken to study it by a method which we believe to be new, and which furnishes in addition a good chance to observe the effect of a definite *Aufgabe* or task set the observer, in that the task here is directly opposed to the mental processes which would naturally occur in the circumstances if the task had not been set. The nature of this method has been already partly indicated. The observer was given the instruction that on hearing the stimulus word pronounced she was to respond by giving a word that had no association with it. She was further forbidden to take refuge in the too easy plan of giving a word suggested by any of the surrounding objects. She was not told to react as quickly as possible, but was allowed to take her own time. There were in all eleven observers, all women, but upon two of them only a few experiments were made.

In a certain number of cases the effect of these instructions was so to "set" the observer's mind that *the stimulus word did not start any associations at all.* "Thought of nothing at first;" "Stimulus had no effect at all;" "No associations with stimulus word;" "Stimulus just a word, auditory motor;" such are some of the statements describing this condition. For all the observers but one, A, cases of this kind occurred less frequently than those where the stimulus word started at least one or two associated ideas, *the train of associations being with effort broken off or inhibited.* These were the two ways in which the instructions were carried out. In a certain proportion of cases *the observer failed to carry out the instructions;* the reaction word was really connected with the stimulus word by a clearly realized chain of ideas, which the observer had found it impossible to inhibit. One observer, Cr., in the earlier experiments seemed to feel that she had carried out instructions if she followed the train of ideas started by the stimulus word far enough away to make the reaction word sound unassociated to one who did not know the intermediate links: thus with the stimulus word "match" she followed a train of ideas until she came in thought to a nail

on which her match box is hung, and gave "nail" as the reaction word. Practice overcame this tendency to a considerable extent. Under the head of failure to carry out instructions may also be classed the cases where the reaction word was given as unassociated when there was really a sound association between it and the stimulus word: the fact that they were unassociated in meaning seemed to make the reaction word elude the inhibiting influence of the *Aufgabe*. Thus for example take the following: "Stimulus word 'pearl,' reaction word 'puppy.' Introspection: 'no associations with stimulus word; the sound of p seems to have been the link.'" Or as another case: "Stimulus word 'curtain,' reaction word 'concert.' Introspection: 'No images. Concert came from sound suggestion of c.'"

These, then, were the typical methods of reacting to the stimulus word itself as a consequence of the instruction to answer with an unassociated word: either the stimulus word was, so far as the obse ver's introspection went, without any associative effect; or it started a train of ideas which was interrupted by recollection of the instructions; or the train of ideas was not inhibited, the instructions being wholly unfulfilled; or meaning associations were inhibited but sound associations persisted and determined the reaction word. We next have the question: How was the reaction word obtained in the cases where the instructions were carried out?

(1) In a considerable number of cases the reaction word was connected with some recent experience of the observer's. Thus for example: "Stimulus word 'easel,' reaction word 'oranges.' Introspection: 'Associated words and picture of Hudson River all inhibited: recent experience of seeing oranges came into mind.'" "Stimulus word 'path,' reaction word 'steamship.' Introspection: 'Visual and verbal images—bridle path, horse, O's brother—all inhibited. Visual image of picture of boat seen recently.'" One observer in particular, B, was especially given to this method of getting a reaction word, using it in 23% of 164 experiments. Observer Ab, on the other hand, furnished no instances of this type in the 72 experiments made with her. It may naturally be asked what determined attention to a particular recent experience rather than to others: why did the observer think precisely of the oranges she had recently seen and not of some other object lately experienced? The observers could give no answer at all to this question.

(2) Another device, closely akin to the one just described, by which a reaction word could be obtained that would escape inhibition by the *Aufgabe*, consisted in what the observers sometimes called "taking a walk." That is, the attention was drawn to memory ideas of the surroundings, usually the out-of-doors surroundings, of the room in which the experiments occurred. Since the observers were forbidden to get their reaction words from present objects, this was a kind of outward roaming in space, as the recalling of recent experiences was an outward roaming in time. Examples are the following: "Stimulus word 'eraser,' reaction word 'lamp.' Introspection: 'Visual pencil suggested, then no further associations; process of hunting around out-doors for something to say; came to arc light by lodge.'" "Stimulus word 'broom,' reaction word 'piano.' Introspection: 'Had no associations. Went wandering around the halls, then into Assembly Hall and saw piano."

(3) In another set of cases the reaction word is derived from verbal perseveration. This set may be subdivided in the following way. (a) Sometimes the reaction word is itself a perseveration. There were four subclasses under this head. The first subclass com-

prises those instances where the reaction word is a recurrence of a preceding reaction word. There were altogether six examples of this: in all of them the previous occurrence of the reaction word was at least six experiments back. In every case the reaction word was recognized by the observer, in giving it, as having been given before. The cases were as follows: "Pipe-pencil" (previous day); "maze-steamship" (12 experiments before); "game-bush" (7 experiments before); "canoe-bird" (6 experiments before); "fur-silver" (six weeks before); "frame-appletree" (apple one month before). The second subclass includes those cases where the reaction word is a recurrence of a previous stimulus word. There were three such instances: "hammer-nest" (7 experiments before); "umbrella-cane" (3 experiments before); "easel-canoe" (2 days before). "Umbrella-cane" was really a direct association, and was criticized by the observer as "too near" as soon as she had given it, but she also recognized the influence of the stimulus word "cane" which had been used shortly before. A third subclass includes cases where the reaction word was one recognizd by the observers as having been used in recent experiments of a different kind; there were three such cases, namely, "roof-float;" "teapot-hen;" "orchard-barouche." In the fourth subclass we have placed three examples from one observer, W, who is of a decidedly motor-verbal type, of the use of words as reaction words which have a general tendency to recur in all experiments of any sort with this observer: favorite words as it were. The cases were: "net-holiday," "key-sermon," "trout-star," "school-comet."

(b) Sometimes the reaction word, while not itself a perseveration, is suggested by association with a word which perseverates. The association may be either through sound or through meaning, and as before, the word which perseverates may be either a former stimulus word, or a former reaction word, or a word from some other source. There were six cases where the reaction word was suggested by sound association with a former reaction word which perseverated. They were the following: "Floor-capitol," from sound of "candle," reaction word 7 experiments back; "Canopy-fringed," from sound of "fright," r.w. on previous day; "Whistle-billow," from sound of "willow," a favorite word of the observer's, used as r.w. three experiments before; "Bush-stand," from "strain," r.w. on the previous day; "clock-answer," from sound of "absence," preceding r.w.; "Alcohol-arrest," from sound of "absence," r.w. 5 days before. There were also six cases where the reaction word was suggested through association with the meaning of a previous reaction word which perseverated. They were: "Broom-candle," from "silver," preceding r.w.; "Pencil-bluebird," from "willow," preceding r.w. and a favorite word of the observer's; "Sermon-rubber-tire," from "popgun," preceding r.w.; "Stone-sparrow," from "willow," favorite word; "Key-orange," from "pink," r.w. 10 experiments before; "string-kite," partly direct, but influenced by preceding r.w. "boy." There was one case where the reaction word came through sound association with a preceding stimulus word which perseverated: "Ladder-violet," through sound association with preceding s.w. "violin." There were three cases where the reaction word was suggested by meaning association with a perseverating stimulus word; as follows: "Jabot-tree," the reaction word suggested from the previous stimulus word, "camp;" Match-snow," from the stimulus word "sled," three experiments back; "Umbrella-bird," from the preceding stimulus word "net." It may be noted that in this gen-

eral class (b), where the reaction word is not itself a perseveration but is suggested by a perseverating word, the word which perseverates is apt to be of more recent occurrence than in class (a). There were eight cases under class (b) where a word perseverating from the preceding experiment exerted an influence, and no case under class (a) where a word occurring less than six experiments previously recurred. This is probably due to the influence of the *Aufgabe:* in seeking unassociated words, the actual repetition of recently occurring stimulus or reaction words would be avoided, but their influence is exerted indirectly through association.

(4) Closely allied to the perseveration of words is the apparently spontaneous occurrence of certain letters as initial letters for the reaction word. In all the experiments performed there were fourteen such cases: the following may serve as examples: "Stimulus word 'string,' reaction word 'lace.' This sound persisted and was inhibited: l came." "Stimulus word 'easel,' reaction word 'rain.' J's and s's inhibited; r chosen." The experience seemed to be that of inhibiting meanings in general and trying for something purely auditory-motor: why several initial consonants should sometimes be inhibited or rejected before one was finally "allowed" to suggest a word, the observers themselves could not explain.

(4) In a very large number of cases no reason whatever could be obtained from the introspections of our observers for the occurrence of the reaction word. For the observers who were most thoroughly tested the percentages of such unexplained reactions were as follows: A. (155 experiments in all), 43% unexplained; Ab. (72 experiments), 30% unexplained; B. (164 experiments), 26% unexplained; Ch. (35 experiments), 25% unexplained; Cr. (71 experiments), 43% unexplained; S. (32 experiments), 40% unexplained; W. (61 experiments), 28% unexplained; Y. (34 experiments), 70% unexplained. Observer Y had had no previous training in introspection, which may in part account for her high percentage; W had had more than the others, Ab. came next, and the rest were equal as regards their introspective experience. A few examples of these unexplained reactions may be quoted.

Observer W. "Stimulus word 'soup,' reaction word 'tragic.' 'Soup of the evening' came verbally, image of Mrs. K. Inhibited; impulse to think of abstract word: 'tragic' came purely as auditory-motor word."

Observer W. "Stimulus word 'path,' reaction word 'salmon.' Faint visual images of path to Sunset Hill and words 'Sunset Hill.' Inhibited: 'salmon' purely auditory-motor."

Observer A. "S.w. 'sled,' r.w. 'figure.' No associations suggested by s.w.; r.w. came purely as a word, without images."

Observer S. "S.w. 'door,' r.w. 'circle.' Word 'gate' inhibited; visual image of a circle came without apparent connection."

Observer Cr. "S.w. 'saucepan,' r.w. 'ring.' Stimulus word inhibited at once; got visual picture of gold ring."

How is the occurrence of the reaction words in all these cases to be accounted for, when the observers themselves can give no explanation of it? In a good many cases, probably, better introspection would show that some recent experience is responsible for them, and that the instances belong, therefore, to the class which we have numbered (1). In other cases the reaction words may be verbal perseverations not recognized as such. To call an idea, whether verbal or otherwise, a perseveration is, however, only partially to explain its occurrence. In so far as it has been recently or fre-

quently in the mind, we know that it has a certain readiness to recur at the bidding of slighter causes than would produce it if its previous occurrence were of earlier date or rarer; but of what causes actually do produce it we declare ourselves ignorant when we call it a perseveration. Since those causes do not appear in consciousness, we must think of them as merely physiological processes, and the question whether they are of the same nature as the processes which underlie association,—whether the cases in question are really, that is, mediate associations,—or whether they consist in the "spontaneous" recurrence of activity in certain neurone groups, is one we cannot answer.

(5) In a certain number of the experiments the stimulus word and the reaction word were really associated quite directly, but the observer did not recognize the fact at the time the reaction word was given. She believed herself to be obeying the instructions and giving an unassociated word, but immediately after pronouncing the reaction word she realized that it was not unassociated, but connected immediately with the stimulus word. It is not possible to draw a hard and fast line between cases of this type and true mediate associations, as we interpret the latter term. The distinguishing mark which we have attempted to apply is this: in cases of the type now being discussed the association between stimulus word and reaction word is direct, although not recognized at the moment when the reaction word occurs to the observer's mind. In cases of mediate association the connection between stimulus word and reaction word is through a well-marked intermediate link, which is not in consciousness at the time when it functions to connect the two. Probably in the cases which we are now considering, of direct though unrecognized connection between stimulus word and reaction word, the instructions are responsible for the fact that the connection *is* unrecognized. The observer is told to avoid associations with the stimulus word: the way to avoid associations is to direct attention away from them, and thus to ignore them when they are present. The following may serve as illustrations of this class of cases.

Observer Ab. "S.w. 'net,' r.w. 'rush.' Tennis images inhibited: mind a blank; after giving r.w. realized its association with tennis."

Observer Cr. "S.w. 'game,' r.w. 'tree.' Saw small balls and discs used in game; then had basket-ball associations, inhibited them, saw a tree; after giving word realized that it was the tree on the basket-ball field."

Observer A. "S.w. 'violin,' r.w. 'Easter.' Both were mere words, with no apparent association, but after giving r.w. thought of Easter music in which a violin was played."

Observer Ch. "S.w. 'fork,' r.w. 'lemon.' Images of spoons, knives, *etc.*, then absolute inhibition. Then visual picture of lemon; after giving word saw lemon fork on dish of sliced lemon."

(6) We come now to the cases of true mediate association found in these experiments. Before quoting them we must take account of one consideration. We have just said that probably the occurrence of the cases classified under (5) is due in part at least to the influence of the instructions. Stimulus word and reaction have a direct, conscious association, from which, however, attention is diverted in consequence of the instructions. As soon as the reaction word is given, the association between it and the stimulus word is attended to. Now in a mediate association, on the other hand, we are supposing that the link between stimulus word and reaction word is a more complex affair, and that it is not a conscious affair, but a

purely physiological process. If the case is recognized as one of mediate association, however, and does not have to be relegated to the "unexplained" class, the link occurs to the observer's mind afterwards. But may we not say, then, that in these so-called mediate associations too the link was really present *in consciousness* at the time when it functioned, but was unattended to because of the influence of the instructions? If such be the case, our mediate associations would not deserve the term, because the link would not be purely physiological.

It is not possible to meet this objection with a sharply defined answer, because we are dealing with matters of degree. Who could assert that a process responsible for the succession of one idea upon another is wholly physiological, unaccompanied by even the faintest trace of consciousness? The question as to whether we have obtained in these experiments true instances of mediate association may be held to turn upon another: how much ignoring of processes really in consciousness can be ascribed to the influence of the instruction in our experiments? To recur to the sample of our mediate associations which we gave at the beginning of this article: is it conceivable that the picture, of upturned trees and general devastation seen from the car window, which linked together "south" and "storm," could have been present in consciousness at the time of its functioning as a link, and have been completely unattended to because of the influence of the instructions not to associate? But perhaps, it may be argued, the whole picture did not need to be there in order to establish a connection on the conscious level; some fragmentary process might have represented it in consciousness, might have been ignored by attention, and might still have formed a psychological link, so that no mediate association, or association by purely physiological intermediaries, occurred. Now at this point we are brought face to face with the whole fundamental problem regarding the trustworthiness of introspection. When, after the reaction word has been given, the observer brings into mind the idea of the picture from the car-window, which represents the link, does her introspection, recalling the experiences that intervened between stimulus word and reaction word, discover there any traces of a conscious process representing in any way this link? If it does not, and if it is practised introspection, then to deny its authority is no more and no less than to reject what many of us regard as the fundamental psychological method. It may often be hard to decide whether a given case should be classified as a mediate association or under class (5), just discussed. But there is, after all, a difference between the two classes: in the cases which properly belong under class (5) the observer's introspection, recalling the experiences between stimulus word and reaction word, recognizes that the link was there in consciousness, although not attended to sufficiently to reveal the fact that it was a link; in the true cases of mediate association the observer can find no trace of the intermediate process whatever on reflecting on the contents of the interval between stimulus word and reaction word.

Out of the 662 experiments we made, 77, or 11.6%, gave us cases which we counted as mediate associations. For the observers upon whom the greater number of the experiments were performed, the percentages of mediate associations were as follows: A., 9%; Ab., 19%; B., 7%; Ch., 8%; Cr., 12%; S., 15%; W., 16%; Y., 14%. There follow one or two typical cases from each observer:

Observer W. (who had had much more practice in introspection than any of the others). "S.w. 'saucepan,' r.w. 'birthday.' Vague pictures of observer's room, and of dishes as they had recently been taken from a closet and placed on the table. Inhibited. Word 'birthday' came purely as a word, auditory-motor. Afterwards the connection was traced as follows: the observer had been talking of birthdays that morning with a person some of whose dishes are now in the observer's closet."

"S.w. 'cowboy,' r.w. 'Sunday.' Several words associated with the s.w., among them '101 Ranch,' were inhibited. A blank followed, and then the word 'Sunday' came, purely as an auditory-motor word. Afterwards the observer remembered that on the previous Sunday while in a street-car she had heard people behind her talking of '101 Ranch.'"

Observer Ab. (whose practice in introspection covered several years). "S.w. 'cello,' r.w. 'Frank.' Several visual images and words connected with music occurred and were inhibited. The word 'frank' came with the adjective meaning attached. Afterwards, the word became a proper name, that of a professor of music among the observer's acquaintances."

"S.w. 'newsboy,' r.w. 'ocean.' Ideas of the *Tribune's* dinner for newsboys occurred and were inhibited. The word 'ocean' came accompanied by a visual picture of the ocean. The observer then remembered reading in the *Tribune* an account of the stranding of the *Princess Irene*."

Observer A. "S.w. 'bell,'" r.w. 'Egypt.' The words 'class bell, Rockefeller Hall,' were suggested; then a blank due to inhibition, then the auditory-motor word 'Egypt.' Afterwards she remembered that Egypt had been mentioned in a class in Rockefeller Hall that morning."

Observer B. "S.w. 'ruffle,' r.w. 'cadet.' A few associations with s.w. inhibited. After giving r.w., remembered having seen a girl starting for West Point that morning with ruffles on her coat."

Observer Ch. "S.w. 'match,' r.w. 'Miss E.' Ideas connected with lighting match inhibited. 'Miss E.' came verbally. Afterwards the word 'maps' came [Miss E. is a professor of history] and its sound association with 'match' was recognized."

Observer Cr. "S.w. 'dustpan,' r.w. 'circus.' Associated images of brooms inhibited. Visual image of circus ring presented itself. Afterwards realized that the connecting link had been 'dust.' (This case perhaps belongs in class (5). Observer Cr. gave few good instances of mediate associations).

Observer S. "S.w. 'pail,' r.w. 'out-of-doors.' Associations with 'pail' inhibited. Picture of 'out-of-doors' as seen from corridor window. Immediately afterwards remembered hearing lately of a certain Dutch painter who always put a pail in the foreground of out-of-doors scenes."

Observer Y. "S.w. 'theatre,' r.w. 'classroom.' Visual images connected with opera inhibited. Visual picture of a classroom; after giving word realized that it was the *music* classroom, from which the observer had just come." (This case, also, might be interpreted as belonging to class (5). Observer Y. had had no practice in introspection).

Of course the possibility must not be overlooked that some of our supposed mediate associations are *ex post facto;* that is, that after the reaction word has been given, and the stimulus word is recalled, an association is made between them which had no function, either

physiological or psychological, in producing the reaction word. Yet to suppose that this was regularly the case would be to leave the origin of the reaction word completely unexplained. It certainly seems likely that in the majority of cases where a reaction word occurs with no other demonstrable reason for its occurrence, the reason is to be found in a link which immediately afterwards presents itself to the observer's consciousness: the burden of proof would lie upon the person who should deny such an explanation. Very likely some of the cases which we classed as mediate associations do not properly belong under that heading. But we are convinced that the method furnished us with a number of associations whose link was physiological rather than psychological.

The peculiar feature of our method lies in the nature of the instructions given to the observer, and it will be well to summarize in closing the effects which those instructions had. The instructions set up, as it were, a barrier against the occurrence of the series of processes that would have followed upon the stimulus word in ordinary association experiments. What was the nature of the processes which, to continue the figure, got past the barrier? They were, briefly, the following:

(a) Sound associations. The instructions diminished attention to meanings, since through meanings associations most conspicuously arise, and sound associations consequently took on increased influence.

(b) Perseverating ideas from recent experiences. The checking of the train of ideas which would be naturally suggested by the stimulus offered an opportunity for these to assert themselves.

(c) Perseverating reaction words, and to a less degree perseverating stimulus words, but not those used in immediately preceding experiments.

(d) Words associated through sound or meaning with perseverating reaction or stimulus words, even those of the experiment immediately preceding.

(e) Directly associated ideas which are, however, not sufficiently attended to to make the fact of their association clear: this failure to conform to the conditions of the experiment is probably due to the instructions themselves, which naturally have a tendency to direct attention away from the ideas suggested by the stimulus word, and in these cases simply allow the associative connection to be overlooked.

(f) Ideas which are connected with the stimulus word by an intermediate process which has no conscious accompaniment: mediate associations.

XIX. A Study of the Images Representing the Concept "Meaning"

By Mary W. Chapin and M F. Washburn

"I see meaning as the blue-grey tip of a kind of scoop, which has a bit of yellow above it (probably a part of the handle), and which is just digging into a dark mass of what appears to be plastic material. I was educated on classical lines; and it is conceivable that this picture is an echo of the oft-repeated admonition to 'dig out the meaning' of some passage of Greek or Latin. I do not know; but I am sure of the image. And I am sure that others have similar images. I put the question not long since to the members

of my graduate seminary, and two of the twelve students present at once gave an affirmative answer. The one reported the mental unrolling of a white scroll; what he actually saw was a whitish lump or mass, flattened and flattening towards the right. The other reported a horizontal line, with two short verticals at a little distance from the two ends. The suggestion in these two cases is plain enough: meaning is something that you find by straightening things out, or it is something that is included or contained in things. There was, however, no such suggestion in the minds of my informants: for them, as for me, the mental representation of meaning is a simple datum, natural and ultimate."

This passage, from page 19 of Titchener's "Experimental Psychology of the Thought Processes," down to the sentence beginning, "The suggestion in these two cases," was read to a large class of beginners in psychology, and they were asked each one to introspect as carefully as she could the nature of the imagery which in her mind stood for the idea "meaning;" that is, represented not any particular meaning, but meaning in general. The students, all women, responded with written accounts that bore the marks of excellent introspection in the great majority of cases, considering that they had had but little training. One hundred and ninety-three good papers were received.

All of the imagery described was either wholly visual (50%), wholly kinaesthetic (36.7%), or visual and kinæsthetic combined (13.3%). Besides this classification according to modality, the images reported may be divided into the two groups of relevant and irrelevant. Relevant images are images whose connection with the word "meaning" through ordinary associative processes may be traced: Titchener's "blue-grey scoop" is a relevant image, because it can be traced to the idea of "digging out the meaning." In the case of irrelevant images no reason can be given to explain the suggestion of the image. The proportion of irrelevant images was decidedly greater where the imagery was visual than where it was kinæsthetic. The following statement summarizes the images in each class.

Kinæsthetic Images

a. *Relevant*

Movements of the head or parts of the head. Frowning, 28. Nodding forward, 7. Sensations from head and throat, 3. Sensations from throat, 2. Stiffening of jaw, 2. Lips forming word, 4. Lip tension, 1. Mouth tension, 3. Teeth set, 2. Eye muscles tense, looking intently, 3. Looking into space, 1. Eyes closed, 2. Eye movements up and down as in looking up word in dictionary, 1. Eyes narrowed, 1. Lifting eyebrows, 2. Wrinkling nose as in pronouncing word emphatically, 1. Shaking head, 1. Turning head to get behind it, 1. These ideas are all classed as relevant, because they are all movements connected either with general effort, such as would be felt in trying to get at the meaning of something obscure, or with pronouncing the word, or with trying to see something; they are all movements that might be made in connection with getting at the meaning of something.

Movements of arm. Stretching up, 2. Grasping, 2. Fist clenched, 2. Grasping something and shoving it away, 1. Raising hand to head, 1. Pulling out a tangle, 1. Pushing against something hard, 1. Pushing forward, 1. Pointing with right forefinger, 1. Groping in the dark, 1.

The connection of all these with the word "meaning" is fairly clear: meaning is something to be reached for, grasped, pointed to, groped towards, disentangled: the pushing, fist clenching, and putting the hand to the head seem to represent merely effort in general.

Breathing movements. Catching breath, 1. Breathing slow and half suspended, 1. These apparently signify effort.

Movements involving the trunk. Leaning forward, 1. Inhibition of all motion, with sensations of effort, 1. Relaxing all the muscles, 1. The leaning forward, like the movements of intent looking, is apparently connected with the effort to *see* meaning. In the relaxing of effort we have the only kinæsthetic image which represents meaning as found or perceived: all the other images of this class are connected with the process of finding meaning, which involves effort, strained attention, frowning, fixed gaze, and so on.

Movements for which the part concerned is not specified. Penetrating dark mass, 1. Delving into something, 1. Poking around in corners, 1.

It is evident that the relevant kinæsthetic images suggested by the word "meaning" fall into two groups. In the first place, we have images of the movements which accompany effort to find the meaning of something, and in one case the movements of relaxation which accompany the discovery of meaning. All these movements are intimately and naturally connected with the process of seeking meaning; their connection with it involves nothing symbolic or figurative. In the second place, we have images of movements which symbolize the mental process itself of seeking for meaning. Reaching, pointing, grasping, disentangling, groping: these are not movements which one actually makes when trying to think of a meaning, as frowning is. They are movements which are thought of in connection with the process because they have some analogy to what goes on in the mind at such a time. It is noteworthy that all these symbolic movements are movements of hand and arm. It is the arm and hand muscles alone which naturally take part in movements that are signs voluntarily used; movements of the facial muscles and of the trunk are more commonly connected with the involuntary, natural expression of experiences. The movements involved in articulating the word must of course be excepted.

b. *Irrelevant*

Only a single kinæsthetic image was reported whose connection with the word could not plausibly be traced. This was the image described as "dragging down till one strikes hard bottom." Very likely it was really relevant in a symbolic way, and was derived from the idea of "getting to the bottom of things;" if the word had been "digging" instead of "dragging," the connection would have been clear.

How far these processes which we have classed as kinæsthetic images were actual sensations resulting from movements at least incipiently performed, we cannot say. Our observers were unequal to the very difficult introspective task of distinguishing between kinæsthetic sensation and kinæsthetic image.

Visual Images

a. *Relevant*

The visual images whose connection with the word "meaning" can be traced may, like the kinæsthetic images, be roughly divided into those where the association is direct and those where it involves

symbolism. Under the first head we have a group of cases where "meaning" is represented by the visual image of an object used in getting the meaning of a word. Just as the most common kinæsthetic image was that of frowning, so the most common visual image was that of a dictionary, which occurred in 13 cases. One observer reported the visual image of a dictionary page; one that of the page with a hand pointing to a word. The image of a person in the attitude or with the facial expression of one looking for a meaning was also met with in several cases: two observers reported seeing the image of a person with a puzzled face, one that of a thoughtful face, one that of a thoughtful face suddenly clearing, four observers that of a person bending over a desk or a dictionary. Visual images of words also occurred. One observer reports "a word in heavy black type followed by an equality sign and other words in small type, each of which has an authority after it in abbreviation." Another sees a word with two or three lines of writing underneath. A third sees a printed page with space between the words and the paper as if the words were raised. So far as this latter feature is concerned the image may be classed as irrelevant, since its association with "meaning" is not clear. Another case of an image which is partly relevant and partly irrelevant is that reported by an observer who saw the word "meaning" itself in print, "the letters having a sneering expression." In the case of the following images the connection with "meaning" is quite direct: "a scowling person pointing at a word and asking me what it means;" "several people discussing."

The number and variety of the visual images which stood for "meaning" through a symbolism which represented the actual mental processes involved in finding the meaning of a word, instead of merely giving the bodily movements or physical objects connected with the expression of these mental processes, as a frown or a dictionary, were much greater than the number and variety of the kinæsthetic images belonging to the same class. These visual images may best be considered in groups according to the particular feature which they emphasize of the mental processes involved in seeking meaning.

(1) *A word and its meaning are equivalent.* Four observers saw an equality sign; one observer saw an equation; one observer describes her image as that of "a large grey bulk with an equality sign, on the other side of which is the bulk broken into small pieces." The equality between a word and its meaning is constituted by the fact that word and meaning have the same associative tendencies.

(2) *Meaning is something to be grasped.* One observer sees "a knotted and gnarled hand extended as if to grasp something." Another describes "something reaching out with tentacles to grasp an idea." Still another sees "a dark brown object with countless dark arms, gathering in more of the brown substance." The symbolism of grasping is probably derived from the fact that meanings are usually complex ideas, whose parts have to be attended to in rapid succession, so that their relations appear.

(3) *Meaning is something to be unravelled or disentangled.* The following images are due to this conception of meaning: "a white background with a faint tracery of intertwined and knotted lines;" "a tangle of fine lines all leading to a black centre;" "a machine stitching and unravelling." The disentangling or unravelling metaphor is doubtless also due to the fact that meanings are complex. While the metaphor of grasping refers to the necessity of *rapid* passage of attention from one element in a meaning to another, so that the

relations may be apparent, the metaphor of disentangling seems to refer to the necessity of definitely attending to the different elements; in other words, to the need of not passing too rapidly from one to another.

(4) *Meaning is the inner aspect.* The following images are evidently based upon this feature of meaning: "Something within something—children's blocks fitting one inside another;" "The innermost part of something which like a nut has an important inner part and less important outer ones;" "A paper bag with a twisted top which opens up;" "A man holding a bushel basket and pouring many silver dollars out;" "A square box, with a piece of string coming from a hole in the centre of the cover;" "The inside of a square box, with something coming out of the front;" "A white something covering something;" "A bronze jar into which I wish to peer;" "Something unfolded piece by piece, like the flaps of an envelope, or petals, to get at the center." As it requires some physical effort to get at the inside of a physical object, so it requires more strained attention to make the meaning of a word or sentence focal than merely to produce the words. Closely akin to this metaphor is that of *digging,* which we found among the purely kinæsthetic images, and which occurs also with visual accompaniments: "Shovel digging into something dark revealing light;" "Some dark substance being parted with hands to get at bright clear object seen in depths." The same aspect of remoteness is involved in the following images: "A spot at the far distant end of a long cone-shaped opening through tiers of layers; the openings in the tiers are, in some cases, eight, in some cases, six-sided,—each opening being smaller than the one before it."

(5) *To get at meaning is to make clear, to illuminate.* This very interesting aspect of the process of getting at meaning was evidently foremost in the minds of a number of our observers. The last two examples quoted under the previous heading give evidence of its influence, and the following show it plainly: "A cloudy sky suddenly clearing;" "A streak of light against a dark ground;" "A single light on a dark ground;" "A dark spot on which a bright light is suddenly thrown;" "Something dark opening up and disclosing a light spot [this involves also the 'inner aspect' idea];" "A dark ditch with a single bright stone at the bottom;" "A dark room with a small glowing light in one corner;" "A black space through which comes a thin radiant stream of light;" "The sun coming from behind a cloud;" "A dark cloud which has just passed over a mountain that is very distinct;" "Many small dark clouds obscuring much light;" "Lighting a candle;" "A glass of dirty water and something dropped into it to make it clear;" "A ball of opaque glass gradually becoming crystal." Why does the metaphor of light coming into the midst of darkness express the mental process of getting at meaning? Is it not principally because darkness and failure to understand are both conditions which produce stagnation and lack of change in consciousness; darkness because it checks movement, and lack of understanding because it checks a free play of associations?

b. *Irrelevant*

The numbers of images whose associative connection with the word "meaning" is obscure was much larger in the visual and visual-kinæsthetic classes than in the purely kinæsthetic class. Doubtless the far greater richness and variety of visual experience as compared with kinæsthetic experience is a sufficient reason for this fact.

Some associative connection does of course exist in all these irrelevant images, and now and then one may hazard a conjecture as to its nature, but only a conjecture. Even in the images classed as relevant there is much that cannot be accounted for: one can see why "light in darkness" should express "meaning," but one cannot explain, and very likely the observer herself could not, why the particular image of "a ball of opaque glass gradually becoming crystal" made its appearance. The visual images for which no associative connection could with any certainty be predicated were the following: A circle; a soft pliable mass of clay; an empty picture frame (possibly these two referred to the abstract nature of the word, no particular meaning being referred to, but meaning in general); a dark grey round substance; a flickering candle; a rolled piece of parchment tied with a ribbon; an oval greyish-white convoluted space with a solid dome over it; a vast plain extending beyond the reach of the eye; the shell of an English walnut, the two halves fitting closely together; little sprites gesticulating wildly; a little girl falling down stairs and skinning her knee; a very bright, rather transparent glow over the whole inner field of vision; a hard small dull yellow surface; a blue green color and a pair of arms with boxing gloves, ready for action; something brown like baked beans; a cold blue long spike; a long sharp knife.

To base conclusions on the vexed question as to the psychological nature of meaning upon these results from unpractised observers would of course be unjustifiable. Incidentally, it may be noted that many of these images are undoubtedly suggested rather by current phrases in ordinary speech, such as "unravelling the meaning," than by the actual experience of the observers in getting at meanings. Yet such current phrases express certain actual experiences in the intellectual life of human beings: they are the records of introspection, however crude; they represent certain features that naturally belong to the process of arriving at meanings. Whether the following statement is an adequate description of a meaning or not, it expresses those aspects of meaning which are apparently most striking and most readily embodied in symbolic form: A meaning is a complex idea, suggested by association with that of which it is the meaning. Its parts must be attended to (meaning must be unravelled, disentangled), usually with some effort (meaning must be dug out; it is the inner aspect), in rapid succession to make their relations apparent (meaning must be grasped). When it is attended to, its further associative tendencies are recognized as identical with those of the word or idea whose meaning it is (meaning is an equivalent). But the word or idea of which it is the meaning did not itself set into activity these further associative tendencies: a block or stoppage in associative processes occurred which made the process of attending to the meaning necessary: the occurrence of the meaning relieved this stoppage (meaning is an illumination).

RECENT LITERATURE ON PSYCHOANALYSIS

By Dr. J. S. van Teslaar

1. S. Freud, Psychoanalytische Bemerkungen über einen autobiographisch beschriebenen Fall von Paranoia (Dementia Paranoides). *Sonderabdruck aus dem Jahrbuch f. psychoanalytische und psychopathologische Forschungen*, III., 1911, 9-68.

A psychoanalytical examination of paranoia would be impossible but for the fact that the patients possess the peculiarity of betraying, at least in some indirect way, exactly those features which lie behind their morbid selves,—while other neurotics instinctively conceal such manifestations. Paranoiacs can not be induced to suppress their internal conflicts; and their utterances and writings furnish material which is particularly valuable for psychoanalysis. Since the paranoiac demands sanatorium treatment, the opportunities for thorough examination of clinical cases are exceedingly rare; and for this reason Freud has chosen, for analysis, a published autobiography of a paranoiac.

This autobiographical record is Schreiber's "*Denkwürdigkeiten eines Nervenkranken.*" It appeared in 1903; and although the author's manuscript had been censored and somewhat curtailed, it created quite a stir in German psychiatric circles at the time.

The author, Dr. S., reports that he twice experienced severe nervous breakdowns on account of overwork. His first illness, in 1884, was diagnosed by Flechsig, under whose care he had been for about six months, as a severe form of hypochondria; but at the end of the following year he was held to be completely cured. Nothing particularly abnormal was noted about the subject's mind during this illness.

His second breakdown occurred in 1893, nine years later. In June of that year he was appointed to the presidency of the senate. He occupied the chair on the first of October. In the interim he had had a number of dreams. They are mentioned in his autobiography because he states that he learned later to attach some significance to them. He dreamed of the return of his former illness. Once, upon an early morning, while lying in a state between sleep and waking, he had a very vivid phantasy "*dass es doch eigentlich recht schön sein müsse ein Weib zu sein das dem Beischlaf unterliege,*"—a bit of imagery which was repulsive to his nature and which his mind, in full consciousness, would have rejected with scorn.

The actual breakdown was ushered in, toward the end of October, by sleeplessness. This brought the patient to Flechsig's clinic again, where, in spite of treatment, he grew rapidly worse. He began complaining of brain softening, and felt that he must soon die. In the midst of these hypochondriac notions, ideas of persecution began to occur. These were fortified by a morbid aural and visual sensitiveness, at first; and later, by sensory delusions together with high-grade hyperaesthesia. These formed the background for a series of hallucinations of gradually increasing intensity which soon dominated the patient's whole sphere of thought. He was now a raving maniac. He

felt himself dead, his body abused and foully diseased. For hours at a time, the patient would be in a hallucinatory stupor; at other times, he was excited and he even attempted suicide. His incoherent mental wanderings gradually assumed a mystical, religious character. He became the plaything of devils; he communicated with God; he heard holy music; he witnessed supernatural phenomena; and he even believed that he now dwelt in another world.

During all this time he was haunted by people, especially by his former physician, Dr. Flechsig, to whom he scornfully referred, in his delirium, as "little Flechsig" and as "soul murderer."

In June, 1894, the patient was interned at a sanatorium, where he remained under observation for a number of years. The sanatorium physicians had opportunity to observe how his psychosis which had been chiefly hallucinatory, and which at first had involved the whole of his psychic activity in a rather acute form, slowly crystallized into a paranoid condition. At the same time, the field of his morbid thoughts narrowed so that alongside his morbidity his former self arose to reassert itself in many relations. His general mental condition improved so much that in 1899 the sanatorium director admitted that the patient was no longer at a disadvantage psychically or intellectually. Apart from some slight psycho-motor symptoms which might have warned the casual observer that there was something morbid about S., he appeared to be a well-behaved gentleman, of refined manner and speech. He showed wide knowledge and wide reading, not only in matters pertaining to his profession as jurist, but along many other lines of activity. He was greatly interested in scientific questions, in art and politics. His opinions on these matters, or on any aspect of social life, were well-thought-out, and interesting, and their ethical import above suspicion. Whenever delicate situations were approached in conversation, and humor touched dangerous ground, S. knew how to glide tactfully over them, if the presence of ladies required it. His wide knowledge and experience made him an interesting speaker; his memory was excellent. As to his morbidly determined notions, they formed a circumscribed and closed system of ideas, into which the light of objective reason was not allowed to penetrate. This was a feature of the patient's inner life which he could not be induced to bring into relation with reality.

Under the circumstances it is scarcely surprising that S. considered that he was capable of taking care of himself in society at large. He appealed for freedom from sanatorium restraint; and he pleaded his cause with all the cunning and the tact which is characteristic of many paranoiacs.

In the petition demanding his freedom, S. denied neither his morbid delusions nor his intention to publish his "*Denkwürdigkeiten.*" On the contrary, he dwelt upon the importance of his unusual experiences for an understanding of mental life; and he pointed out the inability of science to explain them away. As to his hallucinations and delusions, he preferred not to gainsay the testimony of expert physicians concerning them; but he pointed out the harmless nature of the deeds to which they impelled him. He won his case; and in July, 1902, he was freed, although in the decision it was recognized that he was obsessed by the well-known world-savior type of delusion. One year later appeared his "*Denkwürdigkeiten.*"

The particular interest of this case lies in the fact that this common delusion was associated with the unusual obsession that, before he can assume the rôle of world-savior and restore to the human race its lost happiness, he must change into a woman. It appears that this change

of sex was not a matter of choice or preference with S.; but on the contrary it was something decreed, fore-ordained,—a fate he could not escape, and with which he thought it would be best to reconcile himself. Already he was part female. He was gradually losing his male and acquiring female characteristics. Numerous female 'nerves' were running through his body. Through their direct impregnation by God he was to become the mother of a new race. Not until then would he be able to leave this world. But the process was slow; it may take years, perhaps centuries, to be rounded out properly.

All this he learned through direct revelation from God. He was also in constant communication with trees and birds. These spoke to him in voices akin to human; they were charmed, metamorphosed souls, perhaps of former human beings, but now inhabitants of another region.

Conservative psychiatry practically exhausts its interest in such cases when it traces their course and appraises the influence of the morbid system of ideas upon the life and future conduct of the patient; but psychoanalysis goes farther. It attempts to find out the actual mode of onset of symptoms, and to explain them by referring them to some fundamental cause. A knowledge of the etiology of other psychoses, and of the neuroses in general, emboldens the psychoanalyst to surmise that even such an intricate series of morbid thoughts and feelings, as is found in this case, is traceable directly to the commonest and most readily understood impulse of our psychic organization; and that after all, there is method even in the madness of a paranoiac. This is what Freud sets out to prove in his analysis of the case; and he bases his findings exclusively upon the patient's own autobiographical record.

The delusion of a metamorphosis into womanhood furnishes Freud with his first clue. Numerous passages in the book indicate that that was indeed the primary insane delusion. The savior idea was added later, and grew in proportions and in interest until it overshadowed the real nucleus of the whole system of morbid thoughts. The patient's own report also shows that the change to womanhood was devised, in the first place, as an act of persecution first by Dr. Flechsig, later by God himself. The voices spoke mockingly about his changing into a woman; they referred to it in words which showed that the change meant sexual degradation and disgrace. He heard himself apostrophized thus: "Are you not ashamed of your wife?" and "nice person to want to be President of the Senate!" Also, in anticipation of his complete change, the voices accosted him, derisively, as "Miss S.!"

Particular stress is laid upon this feature of the case by Freud. He sees in it an important clue. Indeed a foreshadowing of this idea of effeminization may be seen in the half-dreamy phantasy which the patient had experienced during the incubation period of his illness, that is, before he even assumed those heavy duties to which he ascribes his mental breakdown. The subconscious wish, which had led the patient to fancy that it must be very pleasant to be a woman during the act of sexual intercourse, was blended, as early as November, 1895, with the notion that the patient was destined to become the savior of mankind. And after that time he no longer resisted the idea of effeminization, which had originally been the salient motive of his insanity.

The patient's relations to his God constitute another significant feature of his mental condition. They are so intricate, so contradictory, that any one less sanguine that he is on the right track would be tempted to abandon the idea that they may be reduced to order and system. But Freud, emboldened by these very difficulties, proceeds systematically and patiently to analyze every item of the patient's insane

notions concerning 'nerves,' which play such an important rôle in his hallucinations, concerning salvation, the divine hierarchy, the properties of his God,—the patient's whole morbid system of theologico-philosophical ideas. He finds the whole to be a curious mixture of the most varied notions, some fanciful, cunning, original, others quite commonplace, but fundamentally alike in their implications. Their sex symbolism is so apparent that it is not difficult to trace the real meaning of each. Sometimes, however, the patient's morbid representations are not even symbolical. The notion of heavenly bliss, for instance, is dwelt upon in patently sexual terms, *"als ob S.'s Seligkeitsbegriff durch die Verdichtung der zwei Hauptbedeutungen des deutschen Wortes 'verstorben' und 'sinnlich glücklich' enstanden wäre."*

Thus, briefly summarized, Freud finds that the patient had formerly been inclined toward sexual asceticism and to scepticism in matters of religion, but had been transmuted, by his illness, into a libidinous individual who entertained God-fearing notions. Moreover, his newly acquired sexual desire assumed a most unusual form; it was a female sex feeling. S. felt himself to be a woman in his relations to God; indeed, in the fancy of his insanity, he was God's wife.

He insisted that his skin felt smooth and soft to the touch, like a woman's; and under it, as he pressed lightly with his fingers, he could feel, on any portion of his body, a fine mesh-work of "nerves." They were "female nerves;" and they were particularly abundant upon the breast region. *"Durch einen auf diese Gebilde auszuübenden Druck,"* writes the patient, *"vermag ich mir, namentlich wenn ich an etwas weibliches denke, eine der weiblichen entsprechende Wollustempfindung zu verschaffen."* Particularly is this true of the region where the woman's breasts are found. He also states: *"Das Zeichnen eines weiblichen Hinteren an meinen Körper,—honi soit qui mal y pense,—ist mir so zur Gewohnheit geworden dass ich dies beim Bücken jedesmal fast unwillkürlich tue."*

Relating this condition to the patient's dream-phantasy, Freud concludes that the morbid notion of turning into a woman is only the realization of that unbidden phantasy or day-dream. The patient's conscious self directed itself with revolt against this subconscious wish; and even after his breakdown, he fought against the thought, looked upon the plan as a scheme whereby his enemies plotted to humiliate him. The savior idea, introduced later, was the means of reconciling him to the idea of turning into a woman. This thought brought a new viewpoint into the crisis. The act of effeminization was no longer a degradation; it was God's wish and accorded with His divine plans,—not with the designs of persecutors who were plotting to commit "soul-murder" upon him.

Freud attempts to prove that the two main conceptions forming the backbone of this paranoiac's system of ideas,—his turning into a woman, and his peculiar relations to God,—form a coherent religio-psychic system, in which one is the logical corollary of the other. But the real psychoanalytical task, at this stage, is to correlate the two notions genetically; and to trace them, if possible, to some particular fundamental impulse or instinct which governs the ordinary psychic mechanism of man. Freud finds, further, that the patient's own statements offer all the evidence that is required to settle the origin and significance of the fundamental notions in his system of morbid thoughts. The patient, it will be recalled, is a man of unusual intellect. He is also frank, to the point of bluntness, in the telling of his story. This makes it a comparatively easy task to ferret out the thought-complexes which are responsible for his condition. Often

a quotation, an example, or an illustration used by S. to elucidate one of his insane notions betrays what he actually meant as well as the analyst could have wished. Usually, in such cases, it is only necessary to divest the statements of their prudish negative apparel, as is customary in psychoanalytical work, to take the quotation for the source of the thought, the example for the patient's own thought, and the whole matter becomes at once clear.

Here is a striking example of this technique. Incidentally it justifies, to some extent, this plan of analysis. S. was harassed by what he described as "charmed" or "speaking birds," as has been mentioned already. His insane fancy pictured them as belonging to the ante-courts of Heaven (*"Vorhöfe des Himmels"*). These are metamorphosed human souls whose function it is to serve as messengers. Among the many wonderful qualities ascribed to these birds is that of passivity with reference to the messages they bring him. That is, the birds learn to repeat words in a purely mechanical fashion, without being aware of their meaning. They bring him scornful, mocking, derisive messages without understanding their import. Even birds do not possess an accurate "ear" for sounds; and they frequently confuse similarly sounding words of different meaning. They do not distinguish between such words as "Santiago" and "Kartago," "Chinesentum" and "Jesus Christum," "Abendrot" and "Atemnot," "Ariman" and "Ackerman," etc.

Now, any one who may be disposed to accept the symbolism of which the Freudians make such constant use, would conclude at once that these birds represent young girls. "Chicken-brained" and "geese" are epithets which are sometimes ungallantly applied to girls who think it a mark of culture to employ high-sounding phrases with whose true meaning they are not familiar. Such young women oftentimes betray their ignorance by an inappropriate use of words of different meaning but of similar sound. But one whose attitude towards psychoanalysis is rather sceptical might not be inclined to accept a symbolism which is based upon such slender strands of evidence. The deduction that the birds are girls appears to be rather far-fetched.

It so happens, however, that in this particular instance there can be no doubt as to the justice of the Freudian view. Freud's interpretation is justified by the patient's own statements. The latter writes that, in order to distinguish his frequent bird visitors from one another, he called each by a particular name; and he gave them the names of girls, because, by their coquettish behavior, and in other ways, they reminded him of young girls. These names, in some instances, were approved by God, and thereafter were always applied to the respective birds. The birds, then, were girls; and we find herein a suggestion as to the nature of the "ante-courts of Heaven" with which they were associated in the patient's mind.

Freud finds that an important feature of the patient's malady was not appreciated by his attending physicians at the sanitarium,—namely, the ideas of persecution. In the early part of his illness, S. was a victim of his former physician, Dr. F., who "murdered or was about to murder the patient's soul." The exact nature of this crime is not stated; the portion of the manuscript which gave the details was withheld from publication by the censors. It appears, however, that the crime involved the loss of personality and self-respect.

The soul of his persecutor, for he dealt with the soul not with the earthly person of Dr. F., was polymorphous. At one time

there were as many as forty or sixty divisions or different forms of F.'s soul which tormented S. But of these, only two, the "upper F.," and the "middle F." persisted. It is noteworthy that the patient takes considerable pains to show that he himself distinguishes the polymorphous or bipartite "soul Flechsig" from the living person by that name,—the insane delusion from the real man.

Those who are familiar with psychoanalytic literature will recall the simple formula which has been proposed for the treatment of all manias of persecution. The person to whose hands the patient traces all the strings of the plot is in reality one who, before the breakdown, occupied the center of his emotional outflow, or one who now serves as a substitute for such a person. Under the powerful inhibition or restraint of that emotion, the strength of the emotional tone is perceived in terms of external power; and the emotion is replaced by its opposite as a subterfuge. The former lover or surrogate turns persecutor, and is now hated and feared. The greater the ties of love that bound the patient to him formerly, the greater is the power he now wields over the unhappy patient.

In the case under consideration, it will be recalled that during the prodromal stage of the disease, the patient dreamed a number of times that his former illness had returned. Placing this phenomenon and the patient's day-phantasy side by side, as indeed they co-exist in the patient's own experience, we see that his former illness recalled to mind the physician who had then treated him. The dreams must have owed their meaning to the wish to see Dr. F. again. The sexual phantasy that it would be pleasant to be a woman in the sexual act, must have had Dr. F. for object. The patient's wavering statements require but slight analysis to show that what he really feared and fought against, was sexual misuse by his physician. The subconscious homosexual wish became an act of persecution,—hence, the fear of "soul murder," and the delusion of a soiled, diseased, dead body. These symptoms are tongues of fire which show that the homosexual libido has broken out from within, and is being repressed. Thus interpreted, the symptoms fall into line logically, and almost explain themselves.

But it is not easy to understand why a gentleman's gratitude toward his former physician should change suddenly, eight years later, into a homosexual longing. Perhaps the character and mental calibre of the patient in question add to the difficulty. Freud meets this difficulty with considerations of a general order, whose strength and potency will be estimated differently by different readers. The theory, of course, is that man gravitates between heterosexual and homosexual feelings throughout his life; and that self-denials or disappointments may, particularly at critical periods, precipitate one into either extreme. There are certain facts which seem to indicate that this generalization holds good in the case under consideration. Thus it appears that at the time of his second breakdown, S. was in that critical period of life when the sexual functions of woman undergo marked changes, and when she becomes, largely on that account, peculiarly sensitive. He was fifty-one years of age. Now, since recently-accumulated evidence appears to show that man's sexual functions undergo certain corresponding changes, and that he also becomes, on that account, easily susceptible to certain morbid influences, it would appear, according to Freud, that the difficulties are more apparent than real. Man, as well as woman, passes through a climacteric phase. Therefore it is reasonable to suppose that, during this critical period

he also is subject to those morbid outbreaks which are frequently associated with the change of life in woman.

But some readers may object that notwithstanding all of this, it seems too fanciful to believe that a patient's sympathy or gratitude toward his physician may turn, some years later, into a perverted, morbid attachment, and break out suddenly with so much force as to cause the complete mental disorganization of a personality like S. Freud anticipates this objection, and meets it with the suggestion that possibly the actual relations between physician and patient may mean more to the latter than is usually the case, in fact, a great deal more emotionallly than their formal intercourse would imply. It is quite possible, for instance, that the patient sees in his physician the *locum tenens*, the surrogate of a person very close to him, perhaps of a person in whom his whole emotional life was motivated subconsciously. Such transfer processes as these are frequent; they have been traced out in great detail in other morbid conditions. Until such possibilities have been disposed of we are not justified in abandoning the explanation altogether. We are certainly not justified in rejecting any view merely because it appears strange and unusual. It may be that, in the otherwise indifferent person of his former physician, S. was reminded of his father or of a deceased brother, with whom he wished to be in close *rapport*. Unfortunately, there are no data at hand concerning the subject's childhood phantasies and sex repressions. But Freud's persistent search through the book was rewarded by the discovery that the patient's father was, indeed, dead, and that a brother also had died. It is quite clear that the disease had its roots in a homosexual wish or fancy, with the person of Dr. F. for its object. The strong repression that followed, the intense struggle to which it gave rise as the patient's manhood rebelled against the unwelcome thought, took on the form of persecution. The contents of the wish-phantasy furnished the subject of persecution and the person longed for became the persecutor. But perhaps the real person longed for through the medium of F. is indicated by his identification with God, in the later course of the disease. At first this identification sharpened the conflict. With God as persecutor, the conflict naturally became more acute than ever. But somehow there ensued the notion that his turning into a woman was God's way of preparing him to become the progenitor of a new race, and the world's savior. He was no longer to become a woman for the sexual convenience of F., but for a divine purpose; the loss of his manhood, therefore, was no longer a disgrace. This change marked an important turning-point in the course of the disease. His ultimate metamorphosis into a woman, for God's sexual convenience, was shifted far off into the future. He will be a complete woman sometime; but meanwhile the person of Dr. S. was not to be molested, and hence the struggle was abated. He felt himself once more free from oppression. This transmutation of manias of persecution into grandomanias is not uncommon. It is supposed to be a process of rationalization, whereby the patient adapts himself to his new system of ideas; but Freud thinks it is unpsychological to ascribe such strongly affective products to the purely logical faculty of rationalization. He explains the transfer from F. to God, in the case of S., on affective rather than on logical grounds. This way of handling the problem brings one nearer to the very nucleus of the whole situation, as interpreted by Freud.

In the first place, the transfer occurs upon a single level.—that is, F. and God occupy, after a time, the same plane. This important

point is revealed incidentally by S., who overheard a conversation in which F. introduced himself as "God Flechsig." In other words, the persecutor splits into Flechsig and God, just as he had formerly split into "upper F." and "middle F." ;; and just as God splits later into "upper" and "lower" God. In the course of time, this dissociation proceeds still farther; as has been mentioned. Incidentally Freud remarks that this process is characteristic of paranoia. Paranoia splits complexes just as hysteria condenses them; or, rather, it dissociates into their component elements those identifications or condensations which have previously been made by the subconscious.

Freud asks: Who is this God with whom the patient identifies Dr. F? This is the crucial point in the situation. Freud subjects the patient's relations to his God to a very searching analysis, and concludes that his notion of God is nothing more than a fanciful representation of his father. Indeed, the patient's father was a remarkable personality, a man who had played an important rôle in his day. But aside from that, one's childhood fancy always invests one's father with superhuman qualities. A child's deceased father is, to it, a God. Infants' phantasies are wrought together in mythical terms. Strange as this idea may seem to us, the deification of great men is not uncommon among primitive peoples. Even the Romans preserved, for many generations, the habit of deifying their deceased emperors as a mark of honor. It will be recalled that Emperor Vespasian, when he fell seriously ill for the first time, exclaimed: "I fear that I am about to become a God!"

The Freudian notion of the infant's relation to its father is well-known. It is one of rebellious opposition, born of jealousy, mixed with worshipful admiration, inspired by his unlimited powers,—exactly the attitude of S. to his God. With S. the fancy of turning into a woman is a rather typical formulation of the infantile complex and his struggle with F. stands, no doubt, for the well-known father complex.

One more point: Before a subconscious wish or phantasy breaks out, there must have been some keen denial or disappointment in real life, according to Freudian psychology. There was such a disappointment in the life of S.; and that probably had more to do with the outbreak of his insanity than had been suspected. His otherwise happy marital relations were marred only by the non-arrival of an heir. He longed for one very much. The supposition is, of course, that a boy would have proved a satisfactory surrogate for his deceased father or brother, and would have made possible the discharge of all his pent-up homosexual tenderness or love.

2. Oskar Pfister. Hysterie und Mystik bei Margaretha Ebner (1291-1351). *Zeitschr f. Psychoanalyse,* I., 1911, 468-485.

The author has chosen Margaretha Ebner, a thirteenth century religious mystic, for a study similar to that of the life of Graf Ludwig von Zinzendorf. (See this Journal, xxii., 1911, 416-419.) He psychoanalyzes her life in detail and points out the intimate connections between her religious fervor, her devotion to Christ, and her suppressed sex impulses. The latter furnish the content, the former the form of a long series of interesting morbid phenomena. Thus, masked under religious self-abnegation, her libido phantasies center around the physical person of Christ and pass among the religious for commendable self-abnegation,—the sufferings of a hysterical female for the martyrdom of a saint.

Briefly related, the details of her life and the writer's findings

in his study of it, are as follows: She was born in 1291. Concerning the first twenty years of her life very little is known; but during her twentieth year she experienced hallucinations in which she heard God command her to follow him,—a fact which indicates strong internal conflicts. Soon afterwards, in February, 1312, she fell seriously ill; her own description of her sufferings leaves little doubt that this was a hysterical breakdown. From that day until the end of her life,—a period of forty years,—Margaretha Ebner was never free from the stigmata of illness. During her long invalidism she suffered a great deal. At times, her physical tortures seemed almost beyond human endurance. But her bodily sufferings were compensated by emotions of joy and happiness such as few mortals have ever experienced. Her chief religious work,—the "*Offenbarungen,*" is essentially a continuous record of the primary and sublimated manifestations of her libido-phantasies, down to the year 1348. The ascetic restraints under which she lived her uneventful, comtemplative life, only served to accentuate her morbid disposition. Hers was a true martyrdom of the flesh and spirit, though not of the kind imposed by the church, nor in the sense in which her memory has been sanctified by the pious.

Her concentration upon religion and her devotion to Christ, were so complete that few ties reminded her of the greater world outside; and in the course of time, she severed herself entirely from the world. She became estranged even from her own family, so that she was rather displeased when a sister visited her once at the cloister. Only toward Heinrich von Nordlingen, her confessor and admirer (probably also her junior in years), did she maintain cordial relations throughout her life. It was he, who, as her confessor, inflamed her soul with the desire to lead the secluded life of a nun, and to devote herself wholly to Christ. So well did he succeed that soon the pupil surpassed the teacher in self-abjuration. Her former spiritual leader and confessor turned into a humble admirer and follower of the pious nun, "*ir armer unwirdiger friund, ein clein wirmelein, ein suntlicher hinwurf aller geschepf.*"

Many details about her long illness are not recorded as accurately as might be desired. It is particularly unfortunate, for the purposes of a thorough analysis, that no data are at hand concerning her childhood; and no indications of her infantile repressions are obtainable. Then, too, the last years of her life are also shrouded in darkness. But it is known that her life in the cloister and her relations to Heinrich remained unchanged until the last; and it is almost certain that the condition of her health had not changed to any marked extent until shortly before her death in 1351.

From 1311, when she fell ill for the first time, until 1326, she remained half paralyzed, and had to be carried about. During the last thirteen years of this period, she was obliged to stay in bed half of the time. Her condition was so delicate, and her crises so severe that time and again her end was thought to be a matter of only a few minutes. So great were her sufferings that she often prayed that death might come as a relief to her sufferings.

Her astasia-abasia was intermittent. Through the intervention of divine grace she would frequently regain the use of her limbs. How long the relief lasted is not stated. Intense pain accompanied every attempt at motor activity. Her biography describes an attack of toothache and headache which lasted six weeks, during which time her head was so intensely painful that she could not bear to move it. She also experienced sharp pains in her heart. These were brought on by read-

ing of the sufferings of Jesus. The sorrowful look of the crucified Savior gave her "*ains innern smerzen in minan henden, as si mir erdent werent und zerzerret und durchbrochen wern, und want (cried) daz si mir imermer unnutze werent.*" In other words, she transferred to her self the supposed condition of the hands of the crucified Savior. She even felt that the skin and bones of her hands were stabbed, broken through and shaken with pain; and so violent were her sufferings that the sisters could hardly control her with their arms. She felt a most painful breaking in all her bones, particularly in the sides and back, as well as in the arms and legs; at the same time, she was almost completely overcome by a horrible sense of impending death.

Hyperesthesias were common, and so intense that she could not bear to be touched on either body or limbs. The description of her "heart cramps" is very remarkable. It required the combined strength of several sisters to keep her under control. One would press under the sufferer's heart, while another would counterpress from behind, and the two would feel something alive turning under their hands,—a clear case of hysterical pregnancy. The woman's own description of her cramps suggests this diagnosis. She states that during her cramps she would swell "*als eine frawe diu groz mit einem kinde gaut.*" The swelling also appeared on the face and hands.

One day, while contemplating the passions of Jesus, a light entered her eyes and from there suffused slowly through every part of her body. She was so charmed by the sensation that she could scarcely regain her breath. On another occasion, at supper, her mouth contracted suddenly so that she could not eat. Usually, after Easter, she passed for one to three days into a peculiar state, during which her body felt hot and cold alternately. Among the automatic morbid restraints to which she was subjected, her involuntary silences, alternating with involuntary cries, chiefly of the name of Jesus, are the most noteworthy. At first, she observed silences at regular periods as a part of her ascetic rules of conduct. But after a time they became involuntary. The same is true of her frequent fasts; she soon lost control of the situation here also. Usually the silence and the fasting occurred simultaneously.

The silences were accompanied by a feeling of heavenly joy and peace; but they were interrupted by agonies of pain and fits of weeping. At times, however, exactly the reverse was the case. During these periods of enforced silence she retained power only for prayer. The uncontrollable outcries which usually marked the close of her hysterical mutisms were pitiful to hear; they were brought on, as a rule, by a contemplation of the sufferings of Jesus. It is repeatedly stated that these outbreaks were induced by a contemplation of some phase of the life of Jesus, such as the passion. But Jesus was also the means of her experiencing "*suezzen herzenslust;*" and frequently the passage from pleasure to pain and back again was very sudden. These and other circumstances betray the erotic nature of the hysterical phenomena. Even the name of Jesus alone, if frequently repeated, was sufficient to fill her heart with an indescribable happiness. There was something even about her most acute sufferings which gave her ecstatic satisfaction, especially if witnesses were present, and if sympathy were aroused.

The nun's intellectual faculties were, of course, markedly influenced by her hysterical state. Quite frequently she experienced hallucinations, such as the filling of her heart with a light which overflowed and suffused into every part of the body. Gustatory hallucinations also were frequent. The name, Jesus, repeated during prayer, filled her mouth with sweetness; and for the sake of this divine taste she refused to partake of any sweet morsel of food. Nothing tasted so sweet to her as

the sacramental wafer; she could feel the blood and flesh of Jesus upon her tongue all day long. She would drink only water; it tasted so sweet to her that she wondered why people ever drank anything else. In the summer of 1347, while her body was hot and cold alternately and perspired freely, a taste sweet as sugar persisted in her mouth for several days; and for its sake she refused every drop of water. She lost all desire for food in 1334; and for thirty years she abstained from meat, fish and wine. During her frequent silences she was preoccupied with her inner self, and ate nothing.

Olfactory automatisms were rare, but tactile hallucinations very common and vivid. God always appeared to her as Jesus; indeed, she thought of her God solely as Jesus. Once while she was praying to God Jesus appeared for a kiss and an embrace, and grasped her by the heart. The sensation remained with her for a long time. One night, she was awakened by the child Jesus; and instinctively she pressed to her bare bosom the image of the child, which she always carried upon her person. Thereupon she experienced the carnal touch of his lips; and she was completely overcome by the feeling. At another time, she felt herself embraced and kissed by the child Jesus, when, with apparent irrelevance, she suddenly became quite anxious concerning his circumcision.

She lived in the world of her hallucinations so long that gradually all the ordinary innervations of her body became faint; and her corporeal sensations became so subdued that she thought she was floating or was being carried about.

Dreams, visions and inspirations played an important rôle in the life of this mystic. Many of these are described in her autobiographical records. She dreamed that her deceased sister showed her the portals of heaven and an empty stool which awaited her. Angels told her in a dream that Heinrich von Nördlingen was within her body. Notwithstanding the absurd implication of this dream, her belief in dreams was not shaken. The symbolism of these two dreams is easily apparent to one who is familiar with Freud's "*Traumdeutung*."

Most of her dreams were about Christ. In one of them, she saw his naked body, clear and transparent as glass. The vision filled her with a flood of sensations, whose erotic nature is but slightly masked. She thought the body was to be eaten. She saw herself in a dream bedecked with the wounds of Jesus. She saw the child Jesus at play in his cradle; he gave her no peace until she took him in her arms and kissed him; thereupon he embraced her neck, and returned her kiss.

Her attitude toward the cross is very significant. This emblem was a surrogate for the body of Christ. She kept a cross with her day and night; and by pressing it to her heart she could make herself supremely happy. She also carried upon her breast an open booklet containing an image of Christ which she always placed upon the pillow, under her face, before falling asleep. She furtively appropriated from the choir another cross of larger size. This she placed directly upon her heart. Her own cross reached from the throat down, "*und da lag ich denn gedruket uf biz daz ich enschlief in grozzer gnad.*" She had a mania for large crosses. Once she had a strong desire to steal another still larger cross; but it hung too high in the choir, and she could not reach it. One night she dreamed that she was standing before the image of Christ; he came down and offered her his open heart to kiss, and his blood to drink. Once she heard the voice of Christ admonishing her to nurse him, and warning her that if she refused he would withdraw himself from her later when she would need him most. Obediently, she placed upon

her breast a figure of the child Jesus; and she was filled with happiness.

Margaretha maintained long conversations with the child Jesus, whom she regarded as her own child. She learned from him that Mary bore him with great joy, and suffered no bodily inconvenience; and that she was delivered without pain. She asked him whether it is true that Joseph wrapped his first-born in his trousers, and was answered in the affirmative. This ascetic nun was particularly anxious to learn everything about the boy's circumcision. She was told that the operation was painful, and that the child lost a great deal of blood on account of it; but this did not seem to satisfy her curiosity. Again and again she asked questions of Jesus, relating to this point. She also inquired into all details concerning Mary, the mother, and Mary Magdalene. Many of her questions were as pointed as they were sensuous.

One day she discovered, much to her distress, that she had forgotten the words of her paternoster,—a long prayer that she had composed for herself. The prayer recurred to her memory a week later, but slowly; the words sounded "new" to her ears, and it took her several weeks to relearn the whole prayer. This partial amnesia worried her a great deal; and to atone for it she learned numerous other prayers.

Jesus was her tender love; and, as he himself told her in a dream, he was the husband of her soul: "*ich bin ain gemahel diner seel.*" The Savior continually poured into her ears endearing words, erotic sentiments full of carnal significance. After the "sweet" name of Jesus had "sunk" into her heart for the fortieth time she could not so much as place her hand upon her breast without being overcome by a voluptuous sense which spread over her body and diffused into every part. Aware of the sensuous character of her imagined relations with Christ, she heard his seductive voice say to her: "*Ich bin nit ain berauber der sinne, ich bin ain derliuhter* (illuminator) *der sinne.*" A theological juggler of words would hold up this expression as a classic example of religious beauty and truth.

Her relations with Jesus were not only those of a lover. Through them she also gave vent to her motherly instincts. The child Jesus was her own child. In her hysterical pregnancies she called out his name repeatedly. His name was on her lips on every occasion; she was frequently awakened by him from sleep; she conversed with him; she nursed him at her breast; and she was at times frantic with desire to drink "*sin aller creftigostes minnenwallendez hailiges bluot.*"

The name Jesus, the images and the crosses play the rôle of surrogates for the body of Christ. As has been mentioned, nothing is known about her childhood; and hence, her infantile sex phantasies, repressions and acute psychic traumata are veiled in darkness. But even so, it is clear enough that her religious and hysterical idiosyncrasies are the outward manifestations of her repressed sex impulse. Her devotion to Christ, her saintly piety is the veil under which her erotic nature bursts forth with the pent-up force of a forbidden instinct. Her periodic infirmities, notably her astasia-abasia, set in under pleasurable emotions awakened in her by the presence of God, who always appeared to her in the person of Christ.

In the Freudian sense, an hysterical attack is the vicarious consummation of a sexual act. Margaretha's infirmities betray their erotic meaning and origin by the time at which they occur, no less than by their form and stigmata. Under the mask of religious ardor the mystical nun is better able to abandon herself to her libido phan-

tasies; and she can reach the orgasm better in a prone position. Thus her piety subserves the claims of her erotic nature. The spasmodic contracture of her jaws, to cite another example, occurs just at the time when she is about to take food from the hands of her friend, Heinrich. It indicates the conflict between him and her heavenly lover. Assured by the latter that her relations with him will not be changed by her acceptance of food from the former, her sudden contracture is relieved, and she can eat. Her disgust for food appears only after the food passes through the laryngeal region and into the region of the heart, possibly because it there disturbs the feeling of sweetness and happiness, in the same way in which she feels that ordinary sweets would rob her mouth of the sweet taste of Christ.

The failing of her voice marked the highest crest of her erotic crisis. It set in after some hours of crying, representing sexual indulgences; and she herself compared the hoarseness and the increase of pain, by which it was attended, with the breaking through the ceiling of the flames which had smouldered below; or with the brewing of grape juice which requires a vent before the product may be stilled.

Many of her symptoms are phenomena of identification with her lover: the pains in the heart; the emotional outburst at the reading of the passion story or at the singing of a hymn (Vexilla Regis); the broken limbs and body; the characteristic pain in the palms of the hands. In the same way it is suggested that the hypersensitivity, which rendered painful even the slight touch upon her body or limbs, symbolized the Savior's request that Mary Magdalene should not touch him. Her most painful hysterical attack, during which she felt all her bones breaking, and had a strong sense of impending death, occurred on a Good Friday. It represented Christ's sufferings upon the cross. The loss of general bodily sensitivity and the delusion of gliding through space suggest the Ascension of Christ. Even his burial and his lying in the sepulchre were duplicated in her illness, usually after Easter, when for two or three days her body felt hot and cold alternately. Her periods of silence, like the involuntary outcries with which they were usually terminated, bear the marks of their erotic origin in their direct association with the person of Christ. Her visions and her inspirations confirm, in numerous ways, the dual relation of lover and mother which this nun assumed toward Christ.

Many of Margaretha's hysterical phenomena are of a homosexual character; for instance, the orgasm she experienced during the phantasy in which she was sucking "the sweet breasts" of Jesus. She also ascribed to her divine lover a number of female characteristics, —another homosexual trait. It has been pointed out by Freud that the blending of phantasies and wishes which are characteristic of the two sexes are not uncommon in hystericals. And this appears to be true in this instance. There is also an intricate blending of sadistic and masochistic traits in her sexuality. In fact, the polarization of the polymorphous sexual instincts is well-marked in this patient, where, however, the masochistic elements predominate.

When the anarchic whirlwind of antagonistic sex impulses breaks out quite suddenly, Margaretha Ebner becomes a wreck, and her life becomes a long martyrdom. The instincts of womanhood and motherhood had been misunderstood and had been repressed; they break out with pent-up fury and reappear, like the spirits of the barbarian heroes who had been slain in battle, to wage another and

more terrible war. Instead of being taught to recognize and to sublimate their libido into ethically desirable cultural achievements, people are taught to ignore it or to suppress it or to be ashamed of this portion of their racial heritage. The life of Margaretha Ebner, like that of many other religious mystics, fanatics, martyrs and saints, stands out as an example of one of the consequences to which the suppression may lead.

3. S. F. Ferenczi. Anatole France als Analytiker. *Zentralblatt f. Psychoanalyse,* I., 1911. 461-467.

The author points out that Anatole France was as keen a connoisseur of the morbid mind as he was of healthy characters. This gifted French writer usually expressed his psychological views through the medium of the conversations of his literary creations, such as the gentle Abbé Coignard, the genial Monsieur Bergeret, etc. But a *feuilleton* published in the Paris *Temps,* in 1887, describes more directly the views which France held upon the topic of psychiatry. Apart from certain vagaries which are perhaps permissible to one who writes from a literary rather than from a scientific point of view, this paper demonstrates that France's views concerning functional psychosis are very closely akin to those of the modern psychoanalyst. This is shown again, although somewhat more indirectly, in many other passages throughout his literary works. Some of these passages antedate the Freudian literature, and all of them are independent of the Freudian school,—so that, in a certain sense, the new psychological movement may claim him as an illustrious predecessor in the field of *belles lettres.* In this paper France describes a case he had known in childhood, which illustrates the mechanism of psychic repression and its relation to circumscribed amnesia; this shows that France was fully aware of these psychic processes in 1887. The case in question is that of a learned gentleman, a kind-hearted soul, a scholar of high attainments, whose mind was shaken by the drowning of his twenty-year-old only son. His morbid state manifested itself thereafter only in a certain peculiarity of dress. The patient wore a coat of sack-cloth. He presented such a novel appearance that children followed him upon the streets; but his mild demeanor combined with the suggestion of leonine strength in his superb physique always enabled him to keep them at a respectful distance. His first thought upon entering a house was to drape his coat of sack-cloth over the back of a chair with his hat and cane in such fashion as to suggest the figure of a man. He would then examine the figure from a distance, as one might look at a long-lost friend, correct its appearance by re-adjusting the hat or the coat; and when satisfied with the result of his effort, he would leave the figure and devote his undivided attention to his hosts and their other guests. He was wholly rational and his conversation was quite as interesting as it had been before the time when he became obsessed by his idiosyncrasy. His memory was especially good; yet he never spoke of the drowning of his boy. Nor did he even so much as refer to the incident; this great misfortune seemed to have lapsed entirely from his memory.

For twenty years he lived this eccentric life. But one day his neighbors were surprised to see him without his customary coat. He had discarded it, and appeared among his usual haunts clad in an ordinary suit of clothes. It was noted that his disposition had likewise undergone a change. The poor old man had become suddenly

quiet, timorous and sad. The few words he spoke betrayed internal unrest. Bluish spots appeared upon his cheeks; his lips were dark and hung heavily. He refused to eat. A few days afterwards he mentioned his son's name, for the first time since the catastophe. And the next day he was found, strangled to death, in his room.

So keen an observer of human nature as France did not fail to note the many interesting peculiarities of paranoiacs. It appears that he had a clear insight into their mental mechanism, as is shown by his essay on "Fools in Literature," and by his penetrating analysis of de Maupassant's short stories.

A passage in one of his own short stories, "*'Le manuscrit d'un médecin de village,*" contains a bit of self-analysis by the hero of the story, which would do honor to a trained psychoanalyst.

The incident is as follows: The village physician is called in to see Eloi, a neighbor's child, whose bright intellect he had admired. In fact, the physician, a typical country practitioner of the old school, felt a keen personal interest in his patients who were at the same time his neighbors and friends. He had remained unmarried, and all the tenderness of his emotional nature went out to his patients. He divided his time between them and his grape vines, in whose growth he took an especial pride. He had been in the act of pruning his vines when he received the call. Straight-way he went to the boy's bedside; and he was very much distressed to find that the little patient was suffering from an attack of meningitis. At the same time he felt a remarkable change in himself. It appeared to him that the child was afar off, so far, indeed, as to appear ridiculously small. Yet it seemed that he had been at the bedside for a long time, as though weeks and months had elapsed since he had been called in.

"I endeavored, as usual," says the hero of the story, "to examine these unusual impressions at once; and I soon saw how the situation came about. I loved little Eloi. To find him, unexpectedly, so seriously ill,—I simply could not bear it. Painful moments appear to us to be fearfully long drawn out. That is the reason why the five or six minutes I stood at Eloi's bedside made such an impression of eternity upon me. As for the vision in which the child appeared to me so far away, it came from the thought that I must lose him. This thought which had formed itself in my mind without any coöperation on my own part, had, from the first, the appearance of absolute certainty."

Other passages from his writings show that Anatole France was as intimately acquainted with the rôle of infantile sex phantasies and repressions in the life of the people as with that of the mechanism of the subconscious.

4. Otto Rank. Das Verlieren als Symptomhandlung. *Zentralblatt f. Psychoanalyse,* I., 1911. 450-460.

In his "*Psychopathologie des Alltagslebens,*" Freud has pointed out that the loss of objects is a symptom which betrays a secret indifference or dislike either for the object or for the person from whom it is obtained or with whom its possession is intimately connected in the mind of the loser. The loss of valuable objects may have one of several meanings of a similar nature. It may express symbolically a repressed wish,—thus serving as a reminder of something pleasurable,—but more frequently it represents a sacrifice to the dark powers of fate, a form of barbaric worship which is not yet dead in our midst.

The present contribution consists of a somewhat detailed analysis of a case in which a girl's loss of various trinkets,—gifts from her betrothed,— illustrates a number of unconscious motivations in the Freudian sense.

5. ALBERT MOHL. Berühmte Homosexuelle. *Grenzfragen des Nerven- und Seelenlebens,* LXXV., 1910. Pp. 80.

The theory that homosexuality is a basal impulse, genetically older than heterosexuality,—together with its corollary that our life is a continuous oscillation between the two instincts,—forms so important a feature of Freudian psychology that a work such as the present, recording with much care the homosexual traits in the life of important personalities of both sexes, is of particular interest to it.

The author refrains from suggesting a psychological explanation of homosexual phenomena. The purpose of his work is rather to describe and to trace the homosexual impulse wherever it shows itself in the records pertaining to the life histories of representative people. This the author has done conscientiously; and he has furnished psychoanalysts with an excellent work of reference.

Mohl holds that the homosexual impulse, even when present in a fairly developed form, does not necessarily lead to nor imply the need of its satisfaction *per viam sexualem.* Accordingly he is disposed to regard such tender friendships as have marked the lives of many excellent men and women, particularly during their adulthood and later years, as longings which are essentially homosexual in their nature. Freudians will doubtless agree with the author in accepting this position. It is assumed, of course, that, for the most part, these subjects were entirely ignorant of the true nature of their tender regard for persons of their own sex. Various writers have traced many of the manifestations of puberty to homosexual tendencies. The present author emphasizes this homosexual origin. He holds, however, that persons who leave such puberty traits behind them in their subsequent development should not be classified among homosexuals. The psychoanalytical view would urge, not that such persons have ceased to be homosexuals, but that their homosexual impulses have been directed into new channels and sublimated into useful activities.

6. H. BERTSCHLINGER. Heiligungsvorgänge bei Schizophrenen. *Allgem. Zeitschr. f. Psychiatrie,* LXVIII., 1911, 209-222.

Dementia praecox may be regarded as being due to the penetration of the subconscious into the conscious sphere of psychic activity. In the healthy person the wishes, instincts and phantasies of the subconscious are held in check. A reduction in the tone of repression may be brought about in a number of ways. Such a reduction is not necessarily a symptom of morbidity; it may occur in a healthy individual, where too the subconscious may emerge, in a moderate degree, as indeed it frequently emerges during exhaustion, during day dreams and especially during sleep. Uncongenial occupation, strong emotional conflicts, excessive repression at critical periods of life,— all of these are conditions which may be responsible for a complete mental breakdown.

Analysis shows that ordinarily the morbid manifestations represent reactions which are due to the subject's unfulfilled or unattainable wishes. Sometimes these wishes are masked under opposite sentiments; at other times they appear in their genuine form, perhaps as attainments which are for the patient as fully endowed with the character of reality as are any of his experiences. The specific symptoms are, in

every case, due to the patient's mode of reaction to the new situation. The course of the disease further discloses a definite series of adjustments whereby the subject endeavors to rationalize his new system of thoughts. The symptoms vary, therefore, with the mode of onset of the breakdown; and the nature of the adjustment that ensues directs the course of the disease.

The adjustment marks the beginning of the recovery,—which latter may come about in various ways. It may result from belated sublimation. Or it may be the effect of a more or less violent process of desymbolization in which either the incongruous mass of subconsciously derived thoughts is brought into accord with the facts of external reality, or the latter are brought into agreement with the former. Again the cure may be effected by means of a "transfer of the complex," although this course more frequently leads to nothing better than a temporary improvement.

Conversions into bodily symptoms are common in hysteria. They are phenomena of adjustment. The author gives the history of four highly instructive cases to illustrate this process in detail.

Sometimes patients evade the complex by suddenly breaking away, as it were, from their morbid system of thoughts. Such patients usually pass into a catatonic state of semi-consciousness, out of which they emerge once more capable of living in the world of reality. The period of illness is encapsulated in a circumscribed amnesia,—the patient's mind reverting back to the time preceding the disease. Several examples of this condition are cited by the author as illustrations.

Occasionally a sudden change in the patient's surroundings, or some striking mental incident may have the effect of arousing the patient, as from a slumber, to a realization of his former self.

Desymbolization has been mentioned as a curative agent. The subject either interprets his world of reality in terms of his morbid fancy; or he readjusts the two by translating the world of his fancy into terms of external experience. A harmless and, at times, insignificant symbol may stand for the fulfilment of the subject's morbid wish, as is the case in dreams.

Of particular interest are the author's descriptions of certain patients who manifested symptoms of paranoidal character, in which their efforts at psychical readjustment were followed by cure. These were, for the most part, highly intelligent patients, not over thirty years of age at the time of their breakdown. Two of them, in particular, showed strong though comparatively recent complexes. The author believes that generally where the outbreak centers around recent complexes, no matter how far back the string of complexes may lead one afterwards, the chances of complete cure are greater than where the condition is directly traceable to very early suppressions.

These are, briefly, the theoretical considerations advanced by the author. The histories of the clinical cases which form the basis of his contribution are very instructive, especially because the clinical material is handled conscientiously. At no point does the author display any desire to force his conclusions or to read far-fetched interpretations into his records. On the contrary, he shows a degree of moderation and reserve which is unusual in these days of zealous partisanship. He does not claim, for instance, that he has gone to the bottom of his cases. He believes we still have much to learn about these conditions before we can understand their etiology or the actual mechanism of their cure. For these reasons he is not disposed to attach too much importance to the therapeutic effect of his intervention, even in those cases where cures were effected.

7. S. Freud. Formulierung ueber die zwei Prinzipien des psychischen Geschehens. *Sonderabdruck aus dem Jahrbuch für psychoanalytische und psychopathologische Forschungen*, III., 1911, 1-8.

It is probable that every neurosis tends to draw the patient away from the world of reality. This fact was recognized long ago by Janet, who speaks of the loss "*de la fonction du réel*," as a characteristic of neurotics. The Freudian conception throws a flood of light upon the nature, the mechanism and the meaning of this withdrawal.

The neurotic is an individual who is at war with reality: he turns away from it,—at least from that part of it which becomes unbearable to him. Incidents which have brought about hallucinatory psychoses are denied by the patient, who would thus avoid facing the phases of reality which are most unpleasant or painful to him. The Freudian psychology shows by means of psychoanalysis that the unconscious mental processes furnish both the mechanism for withdrawal, and the new world into which the patient retreats. The subconscious represents the older or primary phase of psychic activity; it is a world which is governed wholly by the principle of pleasure-pain. The processes of the subconscious are evolved in a fashion which insures the acquisition of pleasure and the avoidance of pain. Any elements which are capable of arousing algedonic feelings are suppressed. This suppression is carried out fully in the world of phantasy or of dreams, where there is no conflict with reality. It is also attempted in the waking state, which also is dominated by the pleasure-pain principle. But here the suppression often leads to conflicts out of which the individual may not escape unhurt; and we have, as a result, the various forms of psychoses, from the mildest to the most severe disturbances of personality.

The notion that our state of mental tranquility is disturbed first "*durch die gebieterischen Erforderungen der inneren Bedürfnisse*," was worked out by Freud in his "*Traumdeutung*." In the realm of the subconscious the wish is "*halluzinatorisch gesetzt*," as happens daily in our dream thoughts. In the world of reality the expected wish is not fulfilled; repeated disappointments lead to an abandonment of the habit. The hallucinatory road being abandoned, the psychical mechanism now faces, instead, the real conditions in the external world. A new principle of psychic activity is thus introduced, one which is destined to play a preponderant rôle in the activity of rational life. No longer is only that represented which is desirable, but all that is real, even if it be unpleasant.

It may be argued that this schematic division of psychical activity into a period of eutistic satisfaction of the hedonic impulse (to use a word coined by Bleuler) which precedes the period of rational or conscious mental life such as we know it, appears too schematic to be a true representation of facts. Freud himself realizes the daring position he takes here; and in a footnote he endeavors to justify it by quoting some well-known biological facts which seem to render such a view less fanciful,—the embryo of birds, for instance, represents a psychic system such as is here postulated by Freud. Indeed, the psychic mechanism of a bird during the embryonic period, simple as it is, represents an ideal of eutistic life; shut off from the external world, it receives nothing from it except the warmth from the mother's body. It is not dependent upon that world for its food supply,—the prime lever which moves the whole organic world to adjust itself with external nature.

The human nursling may also be said to live in a world of fancy of its own, and to represent such a psychic organization in which wish

and fulfilment succeed each other without the intervention of a harsh external world which demands adjustments and consequent curtailment of wishes.

In its earliest stage, the child probably dreams of the satisfaction of its needs, which are chiefly nutritive, and although it expresses its wants through motor activity, it attains the dreamed-of satisfaction probably without recognizing at first that its motor activity, such as crying, movement of the limbs, etc., is the means by which it attains the fulfilment of its needs. Reality breaks through into the psychic sphere of activity and there becomes a motivating factor of the greatest significance to the life of the individual. Of course the psychic awakening which leads to adjustment with reality is a gradual one; it is attained through a series of gradual adaptations, the particular stages of which are yet to be worked out.

The increasing significance of the external reality accentuates the function of the organs of special sense; the special senses are called into being in response to the organism's need to adapt itself more adequately to the external world. That portion of consciousness which is devoted to an elaboration of the data derived through the senses, in addition to the pleasure-pain categories of thought which dominate it, becomes acquainted also with sense-qualities.

Gradually there is also being established a special function, namely that of attention,—by means of which the external world is periodically explored for data which may be available for the satisfaction of internal needs. *"Diese Tätigkeit,"* says Freud, *"geht den Sinneseindrücken entgegen, anstatt ihr Auftreten abzuwarten."* The data which accumulate through this periodic activity of consciousness require some means of preservation; and thus there arises a system of mental markings,—the rudiments of what we call memory. The motor discharge serves to unload the stimuli which accumulate rapidly in the psychic mechanism. At first it serves this purpose through more or less purposeless innervations which are directed inward. But this power is soon turned into utilitarian channels outward, into activities; and, by this means, perceptions of reality are turned to purposive ends.

Thus the maintenance of the motor discharge, or activity (purposeless at first, but soon turned into useful channels), leads to the development of all the higher processes of thought; the material for them is furnished by the continuously accumulating mental representations. At first, thinking was probably a subconscious process only,—at least so long as this function limited itself merely to the relations of the objects which enter into the formation of mental images. It acquires the qualities that lift or "transfer" it to the plane of consciousness *"erst durch die Bindung auf die Wortreste."*

The establishment of the principle of reality does not engage the whole psychic field. There remains somewhere in the psychic mechanism a virgin corner into which reality may not protrude, a distinctly circumscribed field subject only to hedonic motivation. Just as a nation whose wealth accrues chiefly from agriculture reserves a portion of its land in virgin state, so the original psychic function of dream-weaving, which begins with play in children, persists throughout adult life in the form of day dreams. This common tendency of our mental mechanism, Freud calls *"das oekonomische Prinzip der Aufwandersparniss."*

It should not be understood that the transfer from the subconscious to the conscious, and the psychic consequences of this change, occur at one time, or very suddenly, or even in any definite order. The sex

impulses follow a path of their own, characterized by what Freud calls autoerotism and latency.

By the former term Freud refers to the assumption, apparently so vital to psychoanalytical theory, that the sex impulses are at first satisfied auto-somatically (*am eigenen Leib*), and therefore do not appear in the category of the suppressions *(Versagungen)* which are created by the break of reality into the psychic mechanism, as do other wish-dreams. "Latency" refers to the well-known fact that the sex impulses find no outlet before puberty. Until that time they remain under the control of the subconscious (pleasure principle); indeed, in many individuals, sex never escapes from that control.

The peculiar position which the sex sphere of activity occupies with reference to the subconscious domain, with its pleasure motivation on the one hand and with reference to reality on the other, establishes for us a closer relation between the two worlds in which we live and move and have our being, than is recognized by genetic psychology at present. To the psychoanalyst these relations are of capital importance not only for the disentanglement of neurotic disturbances, but also for the understanding of the mental processes of the healthy person. The suppression remains all-powerful in the domain of phantasy. It stifles, for instance, all mental images, *in statu nascendi*, if their establishment in consciousness is likely to be attended by painful experiences. The sex impulse may be kept back from adjustment with reality so long that the retention becomes a fertile ground for the subsequent sprouting of various neurotic disturbances.

There is of course a close parallelism between the pleasure-seeking self and the conscious self. They strive for the same ends,—the former in the contemplative world of wishes, the latter in the active world of reality. Employing terms appropriate for each sphere we may say that the pleasure-seeking self conjures up pleasurable wish-fulfilments and avoids painful ones; the conscious self strives for useful acts and against painful ones. The one is a world of action, the other of phantasy; but the ruling principle is the same in both. Thus, viewed broadly, the change from the contemplative or subconscious world to the active, real world involves no degradation of the hedonic principle. Only its terms of expression, its modalities differ in the two regions. A pleasure of limited duration and of uncertain effect is renounced in the one world in favor of another to be obtained later in new terms, in the other world.

The endo-psychic impression of this transfer has been so strong that it has been symbolized in a special religious myth. Freud regards the story of another world as the mythical projection of this psychic transfer. This transfer does not mean a conquest. Religions have not succeeded in conquering the hedonic principle, which, according to this view, is basal to life; they have only changed its terms of expression.

Education may be viewed as a systematic attempt to conquer the pleasure-seeking self,—to aid in its replacement by the conscious self. The love of the educators should be held forth as the prize to be won; education must fail when children are allowed to feel that they cannot, under any circumstances, lose the love of their elders. Art blends the two principles in a peculiar manner. The artist is a man who at first turns away from reality because he is not in sympathy with its demand that pleasurable instincts shall be renounced; he is an individual who finds means to express his erotic and egotistic wishes in the world of phantasy. From this world of phantasy he finds his way back into the world of reality because, thanks to his special gifts, he moulds his phantasies into forms which are appraised by men as precious repre-

sentations of reality. The artist thus becomes the Hero, King, Creator, Darling, that he wished to become, *"ohne den gewaltigen Umweg über die wirkliche Veränderung der Aussenwelt anzuschlagen."*

He accomplishes his aim only because all other people share with him the dissatisfaction which prompts him to artistic utterance,—in other words, because the dissatisfaction caused by the inhibition of the subconscious domain, through the invasion of the conscious self, is itself a part of reality.

While the self transfers from the subconscious plane to the plane of reality, the sex impulses pass from primitive auto-erotism, through various intermediary stages, to personal love, which leads ultimately to the exercise of the reproductive function. This developmental process may be inhibited at any of its stages; and the point of retardation is where the foundation is laid for the development of neuro-pathogenic disturbances.

8. Oskar Pfister. Die psychologische Enträtselung der religiösen Glossolalie und der automatischen Kryptographie. *Sonderabdruck aus dem Jahrbuch f. psychoanalytische und psychopathologische Forschungen,* III., 1911, 427-466.

The so-called gift of tongues, for a long time the concern of the theologian because of the connection of the phenomenon with primitive Christianity, has recently become the subject of scientific research. The bibliography appended to Feine's article, *"Zungenrede,"* in the *Theologische Realenzklopädie für Theologie und Kirche* while not exhaustive, is sufficiently lengthy to impress one with the amount of work that has been done upon the subject.

But notwithstanding the labor which has been devoted to this topic, we possess as yet no satisfactory psychical analysis of the phenomenon. The studies are mostly speculative, and rather abstract, because their authors have had little or no opportunity to study the phenomenon by direct observation. F. Godet's assumption that *"die Glossolalie ist ein Mittelding zwischen Gesang und Wort, ähnlich dem was wir ein Rezitativ nennen"* is as appropriate as any view that has been proposed thus far; but the actual explanation of the mechanism of glossolalia remains as obscure as ever.

The latest work on the subject (E. Mosiman's *"Das Zungenreden geschichtlich und psychologisch untersucht,"* Tübingen, Siebeck, 1911) gives a fairly thorough résumé of previous studies and adds some very suggestive observations. But the latter are based upon impressions gathered rather loosely at meetings of the "gifted-with-tongues;" and hence the author's generalizations lack substantial documentation. The gift of tongues is for Mosiman *"eine Äusserung der Gedanken und der Gefühle durch die Sprachorgane, die temporär unter der Herrschaft der reflexiven Nervenzentren stehen, und die besonderen Formen sind hauptsächlich der Suggestion, die grossenteils aus einer buchstäblicher Auslegung des Neuen Testaments entsteht, zuzuschreiben."* In the dissociation of consciousness which is brought about by the strong suggestion prevalent at revival meetings, *"vorgestellte Bewegungen zu verwirklichen,"* he sees a satisfactory means of explaining religious ecstatic outbreaks, including glossolalia. But this explanation is far from satisfactory. What we need is a systematic study of particular glossolalic phenomena: Only when the results of such an investigation constitute the basis of our comprehensive generalizations may we hope to learn something of real value concerning the psychical mechanism of the phenomenon in question.

It is therefore fortunate that the author of the present contri-

bution has had an opportunity to make a study of cases of the phenomenon. These cases, about six in number, were subjected to psychoanalytical treatment; and the results appear to be a strong confirmation of the Freudian theory, from an unexpected quarter. Here at least we find actual proofs to support the generalizations made and conclusions drawn.[1]

Only one of the cases studied is fully reported in this paper. The patient, Simon, was twenty-four years of age at the time of the analysis (1910); he was the eldest child of ignorant parents. His mother had experienced conversion when the boy was six years of age. The child was very pious; he visited the sick in the village and prayed with them. At school he was rather clever in some subjects, particularly in German; but in the higher grades he experienced considerable difficulty in his French, and in certain other subjects. For this reason, the boy was transferred to a lower grade, and he soon became the butt of the jokes and pranks of the younger boys. They called him "*Stundlipfarrer,*" on account of his religious mien; and humiliated him in numerous other ways. From the age of fourteen to within two years of the time of examination he was employed regularly in a silk mill, where he advanced fron one position to another in due course of time. He had acquaintances among members of different religious sects, but in his sixteenth year, he joined the *Gemeindepfarrer.* He submitted to confirmation one year later. Eight weeks after confirmation, he listened to a pentecostal sermon which impressed him very much; and he also read the passion story of the apostles. Soon afterward while praying fervently, he was surprised to find himself speaking in an unintelligible language. At once it occurred to him that this was the biblical gift of tongues. During the following week he set himself assiduously to the task of exercising his new accomplishment. He also had a very clear hallucinatory vision of the Holy City and at another time, of the Devil; and he heard voices commanding him to do various things.

Upon examination it was an easy task for the analyst to clear up the meaning of these hallucinations because they were nothing more than symbolic representations of the subject's wishes, and convenient means to mask his erotic impulses. The same is true of the religious inspiration experienced by the subject.

But more interesting and wholly novel is the author's analysis of the new language or "tongue." The words of the new tongue were uttered by the subject while fully conscious, and without any special preparation. They fell rapidly from his lips, and were repeated and recorded by the author. This seemingly incongruous mass of nonsense words, when analyzed word by word in the usual Freudian fashion, cleared up as readily as the visual and aural hallucinations; and like the latter they symbolized a long series of wishes and morbid suppressions. Each word, when subsequently repeated to the patient during the course of the examination, aroused half-forgotten memories of childhood, intimate thoughts and wishes, and unpleasant remembrances which the patient had long sought to repress. The results of a number of these examinations were strikingly uniform. Erotic and other phantasies which centered around his former experiences were found to be intermingled, and to break out under the symbolism of hidden phrases. These were, for the most part, distorted words with which the experiences of childhood were in-

[1] Emil Lombard's "*De la glossolalie chez les premiers chrétiens et des phénomènes similaries.*" Paris, 1910.

timately associated. These distorted forms constituted more appropriate symbols, and furnished the semblance of a foreign tongue. In view of the patient's life history and religious experiences, together with his firm belief in his "gift of tongues," it is not surprising that his malady assumed the form of glossolalia.

9. M. WULFF. Beiträge zur infantilen Sexualität. *Zentralblatt f. Psychoanalyse,* II., 1911, 6-17.

Psychoanalysis takes the view that our belief in the child's asexuality belongs to the realm of myths, together with the doctrine of man's primeval innocence and subsequent fall. Sex is not something that comes into play only at puberty. On the contrary, it is present in one form or another from the moment of birth, and it plays an important rôle in every phase of life.

The sex impulse, such as we know it in the adult, is a complex instinct, whose constituent elements undergo a very remarkable evolution during childhood. Only some of these primary elements culminate in the ripening of sex powers at puberty, thus leading to the preservation of the race through the exercise of the reproductive functions; others are directed into various other channels, where they furnish the psychical motive for the production of socially useful activities.

Some of these particular elements which constitute the instinct of sex may be traced as far back as the very first few months of existence. They arise, in fact, in connection with the functions which are basal to life. They are intimately associated, if not identical with, the pleasurable feelings which attend the processes of nutrition, secretion and excretion. The pleasurable sensations aroused about the erogenous zones, mouth, genitalia, etc., during food-taking and excretion are transferred from the infant's own body to external objects, whose contact with these zones is thus capable of arousing the corresponding feelings of pleasure. The signs of this transfer are very numerous in the nursing child. It turns to the nurse or mother as the source of its euphoric satisfaction; the child at the breast is, in fact, not aware at first of any break between itself and the body that nourishes it. That many children cannot be quieted unless they are taken to the breast by their mothers, even when they are not hungry, and after they have been weaned, is a matter of common observation. The warmth of the mother's body, the touch of her warm, soft breast with the infant's hands and lips create a pleasurable sensation. Acquired incidentally, in connection with the satisfaction of the sense of hunger, this pleasure is now craved by the infant for its own sake. It becomes restless and unhappy when deprived of it, even when it has no desire for food. Cases of very small children feigning illness so as to be taken to their mother's breast, after they have learned by experience that they are especially petted when ill, illustrate, perhaps, in a most simple and primitive way how hysterical conditions and similar neurotic phenomena develop around erotic wishes.

The universal over-indulgence of children in tid-bits shows that the intimate relations between libido and the instinct of nutrition persist. In later years the use of alcohol and tobacco replaces this habit in the male; but with woman the love of dainties and tid-bits becomes even greater, and may amount to a passion. The latter may also be the case with adults of both sexes who have remained unsatisfied sexually, and is quite frequently observed in persons who have passed the climacteric period. The intimate relations between the instincts

of nutrition and of sex are richly illustrated in neuroses, psychoses and dreams.

The author joins the extremists who maintain that infantile masturbation is a physiological habit whose function is to develop the external urogenital apparatus into a special sex organ. It arises in infants at a very early period through the sensations around the anal and urethral regions, associated with the functional activity of these parts. The instinct of masturbation is as strong in the infant as it is universal; but it diminishes gradually until about the third year; between the third and the fourth years there is a steep upward swing of the instinct. This is probably the most critical period for the child in every respect, because it is at this time that he is first introduced to the requirements of culture and civilisation; and the infantile impulses and wishes are now repressed by training. The child learns to follow the dictates of the external world more, and those of its own nature less. It cannot have everything that it wishes; and some things in the world, it learns, are not even mentionable. Deeply rooted wishes and phantasies are thus repressed into the subconscious at this critical time in the child's life, and the foundation is laid for the subsequent development of various psychoses and neuroses. Indeed, the first neurotic symptoms which result from the repression,—night frights, urinary incontinence, phobias, and the like.—make their appearance soon afterwards. Infantile amnesia plays a great rôle in later life when the encysted psychic elements break through into the conscious.

The author illustrates these points by briefly citing a few cases of children. Their precocious interest in and their development of sex feelings were perhaps not unusual; but this only adds significance to the author's remark that the child's proneness to onanism is physiological rather than pathological.

10. JAN NELKEN. Ueber schyzophrene Wortzerlegungen, *Zentralblatt f. Psychoanalyse,* II., 1911, 1-5.

The psychogenetic meaning of glossosynthesis is an obscure topic of modern psychiatry. The phenomenon is not uncommon. It is frequently recognized in connection with paranoia as consisting in the formation of neologisms. In dementia praecox the glossosynthetic faculty leads to the formation of nonsense-words,—the *Sprachverwirrtheit* of Kraepelin. Although many writers have observed that certain types of insane patients tend to form new words, this symptom remained without an explanation until it was taken up by the psychoanalytical school. In his well-known analysis of a case of paranoid dementia with incoherence of speech, Jung has shown that the patient's apparently senseless stereotyped expressions contained a deep meaning. In the same way, the secondary language of a schyzophrenic patient was analyzed by Maeder; and Sachs has also discussed the subject. But above all, the path for all such investigations has been laid down by Freud's own observations on the mechanism of the formation of new words in dreams (*Traumdeutung*), in wit (*Der Witz*), and in the lapses of the daily life (*Psychopathologie des Alltagslebens*).

These studies tend to prove that Kraepelin's surmise that "*bisweilen man bie den Wortbildungen sehr deutlich den Einfluss der bestimmten Vorstellungskreise erkennen kann*" is not only justified, but that the newly-formed words *always* relate to the morbid complex of thoughts and may be the means of disclosing its mechanism.

The present contribution deals not with word-formation, but with its opposite, word-splitting and word-derivation by the insane. It is interesting to find that the results obtained in the study of the former phenomenon are confirmed and counterchecked by the results obtained in the latter, thus showing that the psychogenetic mechanism is similar in the two cases.

The author examined a schyzophrenic patient who had formed the habit of splitting words in a wholly arbitrary fashion, and of attaching novel meanings to his verbal fragments. Psychoanalysis revealed the fact that the new words attained their meanings symbolically through the medium of the subconscious; there was no discoverable relation, in the patient's consciousness, between the words and their meanings. His insane thoughts revolved chiefly around incest phantasies. Early in the course of his disease he had evolved for himself a grotesque theory concerning the origin of seminal fluid, as a vicarious representation of the incestuous thoughts which he entertained towards his mother and sister. In his insane phantasies he fought against his father who appeared in the form of a goat with the head of an ox. His mother was the queen of heaven, and appeared under different earthly forms, while he, himself, was a primordial god who had fallen from his high estate because he had been seduced by his own daughter. During his frequent warfare the heavenly queen was sometimes on his side, sometimes on the side of the enemy which was led by his father. These conflicts are reflected in the patient's analysis of words. A few examples follow:

I. Milz = Mehl (Flour) + z;
z = last letter; the end.
Mehl = Korn = Corps + n = 2 parallel lines = mating.
Korn = Horn = männliche Rute = Samen
Conclusion: *Spleen is a seminal organ.*

II. The identification of his mother with the queen of heaven suggested to the patient that he should turn to Catholicism. He wrote a letter to the Pope, begging to be taken to the morning service.
Morgengottesdienst
Mor = 1. Rome (reversed);
2. Mohr = black = devil;
gen = gehen;
Gottesdienst = Gott es dient;
Dienst = die + n + s + t;
n = two parallel lines = marriage = my wife and I
s = snake = woman = wife
t = T = Armburst = Pfeil = Amor = Liebe oder Tod
Conclusion: *Der Jungfrau Maria, der Mutter Gottes zu dienen oder dem Teufel zu verfallen.*

This is a sample of the evidence upon which the author bases his conclusion that the tendency of schyzophrenics, in their play upon words, is to attach meanings which are suggestive of their inner conflicts to apparently neutral words. Word-formation and word-splitting are a sort of auto-psychoanalysis; they may furnish the careful psychologist with an insight into the nature of the complexes which constitute the basis of the disorder.

ALFRED BINET

The death of Alfred Binet, which occurred on October 18th, deprives France of one of her foremost psychologists, and will be felt as a heavy loss far beyond the limits of his native country.

Binet was born in Nice, July 8, 1857. In 1871 he went to Paris, with the intention of studying law; soon, however, he came under the influence of Charcot, and turned his thoughts to medicine. About 1880, he decided definitely on a psychological career, and in 1892 was associated with Professor Beaunis in the direction of the laboratory of physiological psychology at the Sorbonne. In 1895, on the retirement of Professor Beaunis, he was given sole charge of the laboratory.

Binet was a prolific writer, with a typically French predilection for the immature, the exceptional, the abnormal, in psychology, and with strong practical interests. His principal works are *La psychologie du raisonnement: Recherches expérimentales par l'hypnotisme* (1886); *Le magnétisme animal,* in collaboration with Ch. Féré (1886); *La perception extérieure,* a memoir crowned by the Academy of Moral and Political Sciences (1887); *Études de psychologie expérimentale* (Fetichism in Love, The Psychic Life of Microorganisms, The Intensity of Mental Images, The Hypnotic Problem, Note on Hysterical Writing: 1888); *Les altérations de la personnalité* (1892); *On Double Consciousness; Experimental Psychological Studies* (1894); *Introduction à la psychologie expérimentale,* with Philippe, Courtier and V. Henri (1894); *Psychologie des grands calculateurs et joueurs d'échecs* (1894); *La fatigue intellectuelle,* with V. Henri (1898); *La suggestibilité* (1900); *L'étude expérimentale de l'intelligence* (1903); *L'âme et le corps* (1905); *Les révélations de l'écriture d'après un contrôle scientifique* (1906); *Les enfants anormaux,* with Simon (1907); *Les idées sur les enfants* (1909). Several of these books have been translated into English, and one at least into German. Binet also published a long list of articles in various magazines, notably in *Mind,* the *Monist,* the *Revue philosophique,* and the *Revue scientifique.* For a year or two he issued, in collaboration with Beaunis, *Bulletins* from the Sorbonne laboratory. In 1895 he began the publication, with Beaunis, of the *Année psychologique;* in 1897 Beaunis resigned the responsible editorship, and the annual has since been carried on by Binet, with the assistance of a changing staff of collaborators. Much of his

work upon applied psychology is contained in these seventeen volumes, and in 1908 Binet formally devoted the *Anneé* to the study of practical and social questions. In 1897 he founded, with V. Henri, the short-lived but admirably useful *Intermédiaire des biologistes.*

Binet's psychological acumen is best shown, perhaps, in the *Etude expérimentale de l'intelligence,* a study of the intellectual processes of his two little daughters, which he undertook without knowledge of contemporary German work, and which led him to results akin to those obtained by the Würzburg school. On the practical side, he is highly esteemed for the series of mental tests, the first draught of which he published in collaboration with Th. Simon, in 1905. Binet had a dislike of system, and his critical papers are apt to be records of personal impression, set down without regard for perspective. His style tended to prolixity; no doubt, the demands of the *Année* were heavy, and he was often obliged to write when he would have preferred to be silent. He had a large measure of originality and true psychological insight, and he takes rank with the leading psychologists of his generation.

BOOK REVIEWS

Animal Intelligence. By E. L. THORNDIKE. New York, The Macmillan Company. 1911. pp. viii., 297.

Portions of Professor Thorndike's book have already appeared elsewhere; but many pages of new,— not to say novel,—material have been added, and the whole is now presented in a form which is at once more systematic and more readily comprehensible.

The opening chapter discusses the relation of consciousness to behavior, and the possibility of studying consciousness objectively. The author holds that it is quite as legitimate to study consciousness for the purpose of determining what an individual can or will do, as to study behavior in order to determine what mental processes are or may be present; and that psychology may therefore be as independent of introspection as physics is. Nor is there any impassable gulf between physical facts and mental facts, between bodies and minds, between movements and conscious processes. In order to illustrate this continuity of phenomena, the author assumes a case in which one is called upon to learn six things about a given animal,—say, John Smith,—*viz.:* its height, the color of its hair, its toothache, its anxiety, and its thinking of seven-times-nine. The first two items are clearly accessible to objective study. The intensity of the tooth-ache may likewise be determined objectively, by employing certain familiar symptoms as criteria; and the same is true of even such phenomena as anxiety and the processes of thinking. In the latter cases one finds not an absolute inability, on the part of the observer, to tell what John's experience is, but only a greater variability in the observers' estimates; and this variability would be lessened if we possessed a more intimate knowledge of the manifestations of such an experience, and better means of describing, classifying and measuring it. Pain, anxiety and opinions are no more matters of direct consciousness than are height, temperature and color, or than the sun, moon and stars.

The author makes use of this conception of consciousness as a background for his more fundamental hypothesis concerning the relation between consciousness and behavior, and the possibility of obtaining an insight into the nature of the animal mind. Behavior includes consciousness *plus* action. Behavior is therefore raised to a position of supreme importance; and a theory of animal intelligence which is based upon behavior is furnished with a scientific justification.

Chapters II., III., IV. and V. are essentially reprints of the author's well-known papers on Animal Intelligence, Instinctive Reactions of Young Chicks, Psychology of Fishes, and the Mental Life of Monkeys. The text in these four chapters is republished in practically unchanged form, although the author confesses that he finds it difficult "to resist the impulse to temper the style . . . with a certain sobriety and restraint" which the exuberance of his youth did not prompt.

The most general law presented in the chapter on Laws and Hypotheses of Behavior is that behavior is predictable, *i. e.,* that the same situation will, in the same animal, produce the same response either through original or acquired determinants. All acquired behavior falls

under two laws; first, the Law of Effect, having to do with the degree of comfort or discomfort, and, second, the Law of Exercise, *i. e.*, the law of repetition. All behavior can be explained by one or more of these three laws. In harmony with his former publications, the author definitely denies that imitation can determine behavior. Even in the case of the child's learning to talk, there occur fortuitous sounds in the promiscuous babblings which bring satisfaction in the way of parental caressing. In fact, there is no indication in any activity whatever that the idea of a response, apart from instinctive tendency or former experience, is able to produce that response.

The last chapter deals with the Evolution of the Human Intellect. Since Darwin's discoveries, biologists have worked out a fairly satisfactory physical genealogy of the human race. Much less has been done to find the origin of intellect and to trace its progress up to human faculty. The author holds that all animals manifest fundamentally the same sort of intellectual life; and that human psychology is only higher animal psychology. We must trace out a mental series analogous with the physiological series of the biologists. Then and then only will it be appreciated that "amongst the minds of animals that of man leads, not as a demigod from another planet, but as a king from the same race."

Such, in brief, are Thorndike's problems and conclusions. The book takes rank as one of the classics in this field and is all the more important coming from one who has done so much to introduce the experimental method into comparative psychology. It is only with the view of stimulating helpful criticism that the present review ventures to question any of the author's deductions.

Comparative psychologists would, indeed, deem themselves fortunate if they could assume with Thorndike that introspection adds nothing to our knowledge of behavior. They would then feel less keenly that it behooves them to speak "with a certain sobriety and restraint" in exploiting such inferences regarding the nature of the animal mind as they may draw from their observations of animal behavior. But the current literature of comparative psychology voices so many discordant and apparently irreconcilable views that the modern reader is no longer shocked by a theory which subordinates consciousness to behavior. It will probably turn out that psychologists will refuse to endorse this conception of consciousness,—a conception which is neither a natural nor a necessary consequence of the observed facts upon which its author bases it. Indeed, the view of consciousness which is here presented seems to be designed more to justify a procedure than to explain the findings obtained by that procedure.

In regard to his laws of behavior, one is immediately confronted by the problem as to how they will explain concrete cases. Learning to talk is not a good example of imitation. Most psychologists will agree with the author that skill in talking comes through trial and success. What of the numerous cases of reactions which seem to spring full grown from a single immediate situation and which still manifest themselves in terms of the situation? Even though we take the author's estimate of one in ten of this character we have an enormous number of reactions to account for. Must we, in such cases, seek phylogenetically for the basis of an instinct, or ontogenetically for a former experience? Learning to talk is not even typical of many forms of activity which must be explained, although the author gives almost entire emphasis to this one activity and makes little effort to classify others under his laws. The argument that the idea of an act cannot produce the act might be met by the equally demonstrable argument

that the idea of an act is impossible until the reflex physiological component is established. Thought is predominantly motor; and this is especially true of any thought which would raise the question of imitation. Thorndike may deny that a causal relation exists between the idea and the reaction; but it may still be that there is concomitance between the two, outside of experience. The doctrine of psychophysical parallelism is disregarded in the author's assumption without being either disproved or denied. The reviewer finds an apparent inconsistency between certain statements which are fundamental to Thorndike's general position. How is one to reconcile "the same situation will, in the same animal, produce the same response" (p. 341) with "of several responses made to the same situation" (p. 244)? How will these appear in the light of his principle of abstraction (p. 263)? How can all of these views be brought into relation with his definition of "situation" (p. 283)? What is there in the author's generalized Law of Effect (p. 244) which is not circular with his definitions of satisfying and discomforting (p. 245)?

The last chapter is well written and presents a probable psychology of the future. The author ventures to outline how comparative psychology may come to hold the same relation to the psychology of consciousness that biology now holds to physiology. No one now before the public is better fitted by training and experience to arrange this psychic series than the man who has taken the lead in so many other lines of research. Let us hope that Thorndike will find it possible to amplify his last chapter into a companion book in the Animal Behavior Series.

L. W. SACKETT.

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A Text-Book of Experimental Psychology with Laboratory Exercises. By C. S. MYERS. Second edition. Cambridge, The University Press; New York, Longmans Green & Co., 1911. Part I., Textbook. pp. xiv., 344. Part II., Laboratory Exercises. pp. ii., 107.

Dr. Myers' Text-book was noticed in this JOURNAL, XX., 462, on its appearance. It has now attained a second edition—a matter of congratulation both to the author and to his countrymen; and it has been issued, wisely, in two parts.

I find little change in the Laboratory Exercises: an experiment on after-sensations of hearing has been removed, and two experiments on labyrinthine sensations have been added. The text of Part I. has been revised throughout. The most striking additions are the references to Head's 1911 *Croonian Lectures*, which appear in ch. ii. (Cutaneous and Visceral Sensations), xvi. (Muscular Effort), xvii. (Local Signature), xviii. (Sensibility and Sensory Acuity), xix. (Identity and Difference), and xxiv. (Feeling), and the new chapter on Thought and Volition. In the latter, Dr. Myers discusses the question of imageless thought. I am not sure that I understand him; but I will give what account I can of his position.

(1) There is, first of all, the matter of 'act' and 'content.' Dr. Myers believes that the 'act' is introspectively separable from the 'content' in such experiences as perceiving, imagining, attending, thinking, desiring, reasoning, but that it does not show specific differences; always what is left, when contents are removed, is "the conative experience of mental activity." In the case of thought, the separation of 'act' from 'content' is most easily made when (possibly is dependent on the circumstance that) there is difficulty or obstruction in the course of thinking.

(2) The 'object' or 'content' of thought is often imageless. In the race, meaning is prior to thought; and in the individual (in the rudimentary thought of the infant) thought is prior to language. Hence, while imagery and language are necessary for the growth of mind, it is not surprising that we, with this growth behind us, should, especially in abstract or unimpeded thought, employ a "short cut or abbreviation" whose final result is "mere awareness." To do this is, after all, only to discard the elaborate machinery of words and images for a more primitive tool of consciousness; though the tool has, of course, been formed and sharpened under the influence of mental development at large. As for the mechanism of awareness, "the probability is that we come to construct for ourselves various 'schemata,' as Head calls them, *i. e.,* systems of unconscious dispositions," upon the basis of which presentations are apprehended; thus we apprehend size under the unconscious influence of a schema of distance; and there are similar schemata for meaning, and for other spatial, as well as for temporal and logical relations. 'Mere awareness' would then, I suppose, stand for the lowest conscious terms in which a situation can be assimilated to a schema.

(3) Above both act and content of the thought stands a directive awareness: a knowledge, *e. g.,* of whether and how one can solve a given problem. "This need not be present in the form of a thought content;" that is to say, if I understand the author, it may exist simply as an unconscious schema.——

The index to both Parts is appended to Pt. I., so that the user of Pt. II. must turn for his references to the companion volume. This arrangement is a mistake. The author should also know better than to refer to Stout's "Analytical Psychology." E. B. T.

The Philosophy of Music: a comparative investigation into the principles of musical aesthetics. By H. H. BRITAN. New York, Longmans Green & Co. 1911. pp. xiv., 252.

The problem of a 'philosophy of music' is threefold. It has, first, "to determine as clearly and as accurately as possible the nature of the psychological processes involved in the musical experience." This psychological analysis is imperative: for little systematic work of the kind has yet been done; the mental reactions are so subtle and intangible that superficial work upon them leads to exaggeration and vague generalities; and only through psychology can music be related to other manifestations of human thought and action; the principles of musical criticism, *e. g.,* are in the last resort psychologically grounded. The philosophy of music has, secondly, to consider the relation of music, not only to other arts, but also to morality, religion, education. And it has, thirdly, to face the ontological question, and to discover "what is the essential, irreducible content when analysis has reduced the subject to its lowest terms." After an introductory chapter on Musical Form, these three problems are taken up. A 'Psychological Analysis of the Elements of Music' treats of the first,—of the psychology of rhythm, melody, harmony, musical expression; and a 'Philosophy of Music' treats of the other two,—of the universality, versatility and power of music, the content of music, musical criticism, and the educational value of music.

The book has evidently been written *con amore,* and there are parts of it that I have read with interest. I am also unreservedly on the side of any author who seeks to train the musical intelligence and heighten the musical feeling of his time. On the other hand, it is impossible to

grant that the present writer has proved adequate to his task. "While the bibliography of music is voluminous," he tells us, "attempts at a scientific psychological analysis of music, and at a systematic discussion of the principles of musical aesthetics are surprisingly few." Let this be admitted: is there, then, not all the more reason to utilise what we have? And Professor Britan has apparently failed to find—at any rate he has not utilised—Stumpf, or Lipps, or Wundt's volume on Art, or Wallaschek, or Riemann, or Siebeck, or Moos, or indeed anybody of that ilk except Hanslick, to say nothing of the magazine-writers! The omissions are astonishing. And when Hanslick is introduced, his name merely points the difference between 'formalists' and 'expressionists;' why there should be such a difference, or how it originated historically, the reader may think out for himself; that Hanslick stands over against Hauptmann, with Schopenhauer and the evolutionists between, he must learn from other sources. As to the content of music, it has two elements: the sensuous qualities of musical sound, which arouse direct sense-feeling, and musical thought, which arouses an intellectual activity whereby the purest and richest aesthetic emotion is gained. "To explain why such intellectual activity should give pleasure, we shall refer, in lieu of a better one, to the biological theory of pleasure and its function." E. B. T.

Laughter; an essay on the meaning of the comic. By H. BERGSON. Translated by C. BRERETON and F. ROTHWELL. New York, The Macmillan Co., 1911. pp. vi., 200. Price $1.25 net.

Bergson's theory of the comic has now been before the world for some dozen years, and is probably familiar to the readers of this JOURNAL. All modes of human life, he says,—individual selfhood, society, language,—are in their proper nature supple and elastic, alert and active, ever moving and never repeating, irreversible, unique. But there is always the danger of rigidity, of automatism. Whenever, then, we find in human thoughts, words, actions, affairs, anything inert, mechanical, repeatable, stereotyped, we instinctively recognise it as non-adaptive and as requiring correction. Laughter is the social gesture whereby this correction is administered; it implies a certain callousness and indifference, even a touch of malice in the laugher. The sphere of the comic is a sort of neutral zone, beyond the region of emotion and struggle, in which a man's interest in his neighbour is predominantly an interest of simple curiosity, but in which, nevertheless, a sharp lookout is kept for anything that threatens the desirable maximum of elasticity and sociability. Comedy is, therefore, not life; neither is it art; for art is individualistic, its sole object being 'to brush aside the utilitarian symbols, the conventional and socially accepted generalities, in short, everything that veils reality from us, in order to bring us face to face with reality itself;" while comedy looks outward, seeks the similar and the typical. It is not life, while yet it pursues the utilitarian aim of social improvement; it is not art, while yet it comes into being when society and the individual, freed from the anxieties of self-preservation, begin to regard themselves as works of art; it lies, in fact, midway between art and life.

On these principles, Bergson accounts for the whole of the comedian's stock in trade, from the portly gentleman's slip on the orange peel to the cross purposes of Mr. Dale's visit to Patterne Hall. The theory has been assimilated, whole or part, by Lippsians and Freudians, and has been variously criticised by the independents;

all acknowledge the freshness of its outlook, the acumen with which it is worked out, the charm of its presentation; the work has reached a seventh edition in France, and translations are many. The English version, which lies before us, is accurate and readable; its style improves—unless one is misled by the growing interest of the subject?—as the book proceeds. At any rate, it is in the early pages that I have noted inelegancies. "The formula exists well enough in a certain sense," "We might think of an immense avenue such as are to be seen in the forest," are sentences occurring in a single paragraph; "We must distinctly perceive, as though through a glass, a set-up mechanism," "A contemporary philosopher, an out-and-out arguer," are hardly model phrases; 'delimitate' is unnecessary, and 'Iéna' is not English. There is no index. E. B. T.

The Psychology of Education. J. WELTON. Macmillan & Co., Ltd. London, 1911. pp. 507.

In the author's words, "This book is a systematic treatise neither on psychology nor on education." It is intended rather to help teachers to form a practical psychology. All teachers, of course, have some such working theory, but they will be helped, the author thinks, by "generalisations from an experience wider than that of any individual educator, but of the same kind as those which each real educator makes." The teacher is advised that the psychology of value to him, that is, an understanding of the desires, plans, and thoughts of the child, is to be gained chiefly by observing the conduct of those in his charge, and by interpreting it in the light of his own conduct and his own experience, as known by introspection and especially by remote retrospection. The book, then, is a collection of such generalisations, under the chapter-headings: "Education and Psychology," "The Study of Mental Life," "Bodily Endowment," "General Mental Endowment," "Variations in Mental Endowment," "Nature of Experience," "Development of Interests," "Direction of Activity," "Learning by Direct Experience," "Learning through Communicated Experience," "Critical Thought," "Ideals," "Character." It is written at a common-sense level, and fails generally to consider technical and experimental work. W. S. FOSTER.

The Essentials of Mental Measurement. WILLIAM BROWN. The University Press, Cambridge, 1911. pp. 154.

The book is valuable to students in psychology and education as a careful and exceptionally concise presentation of quantitative theory, admirably supplemented by illustrations of its use and results in practice. Part I is a résumé of the general theory of mental measurement, with a description and comparison of the psychophysical methods. Part II deals with correlation. There is a discussion of its general meaning and use, and a clean-cut chapter on mathematical theory. Then follow a review and evaluation of the methods and treatment of data in historical investigations involving correlations. The author gives an account of a previously published investigation of his own, involving the correlation of mental abilities, and then discusses the significance of correlation for psychology in general, outlining the bounds of its usefulness. One is glad to note the emphasis the author puts upon the fact that, in measuring and comparing mental traits, psychology and method come first, mathematics and treatment of data afterward. W. S. FOSTER.

Scientific Mental Healing. H. ADDINGTON BRUCE. Little Brown & Co., Boston, 1911. pp. 258.

The book is a collection of eight essays, slightly revised from their original form of magazine articles. It treats of the evolution of mental healing, the history and methods of various schools of psychopathology (Janet, Freud, Sidis, Prince), of Christian Science and New Thought, discusses hypnotism and secondary selves, touches upon the applications of psychology to education, law and advertising, and adds a chapter on psychical research, and an appreciation of William James. The treatment throughout is of the 'popular' sort —anecdotal, sketchy and superficial. W. S. FOSTER.

Experiments on the Generation of Insects. By FRANCISCO REDI of Arezzo. Translated from the Italian edition of 1688 by M. BIGELOW. Chicago, Open Court Publishing Co., 1909. pp. 160.

Intracellular Pangenesis; including a paper on Fertilization and Hybridization. By H. de VRIES. Translated by C. S. GAGER. Chicago, Open Court Publishing Co., 1910. pp. xiii., 270.

Some Neglected Factors in Evolution. By H. M. BERNARD. Edited by M. BERNARD. New York and London, G. P. Putnam's Sons. 1911. pp. xxi., 489.

Mendelism. By R. C. PUNNETT. Third edition, rewritten and enlarged. New York, The Macmillan Co., 1911. pp. xiii., 192.

The Open Court Publishing Company has made all students of life and mind its permanent debtors by the series of reprints and translations, two volumes of which lie before us. Redi was the first to disprove, by experiment, the generation of living things from dead matter; he is thus the pioneer on the road that led to the theory of biogenesis. Unfortunately, his observations on galls misled him, and he thought that 'the peculiar potency of that soul or principle' which gives rise to flower and fruit also engenders the worms in the galls. The translation is competent; it is, however, to be regretted that the work was not annotated by a biologist.

The *Intracellular Pangenesis* appeared in German in 1889; the paper on *Fertilization* dates from 1903. As Professor Strasburger remarks in an Introductory Note, no 'recommendation' of Professor de Vries' works is needed; they are consulted of necessity by all who are interested in the topics which they discuss. The translator, Professor Gager of the University of Missouri, contributes an interesting Preface.

The late Mr. Bernard is known by his papers in systematic zoology and by his work on the histology of the retina. In the present volume he gives us his general views of the course of organic evolution. Pt. i., *The Protomitomic Network,* outlines a theory of morphogenesis. The precellular unit of living structure is the chromidium, a particle of chromatin from which radiate delicate linin-filaments, and which is set in a fluid albuminous matrix to the surface of which the filaments extend. From the chromidium develops the cell, and from the cell develop in like manner individuals of a higher order; the linin-filaments persist as a continuum throughout the entire organism, and the chromatin collects at the nodes of the network to form nuclei. This theory leads the author to conceptions of histogenesis, ontogenesis and phylogenesis which, in many respects, differ widely from the ideas currently accepted. Pt. ii., *The Cosmic Rhythm,* argues that we can distinguish five great evolutionary periods, each one intro-

duced by a unit resulting from the colony-formation of the unit of the preceding period. The units are the chromidial, the cellular, the gastraeal, the annelidian, and the simian or anthropoid. At all stages there is continuity of structure, secured by the linin-filaments; the successive colony-formations are true structural integrations. When, however, we come to man, we reach the limit of this morphological integration; human societies or colonies are made up of separate colony-units, of separate men and women. Yet the principle remains the same; for the essential factors in the evolutionary process are the stimuli transmitted by the network; and if we can find transmission of stimuli between the members of human society, we have a right to speak of social integration. Now such transmission occurs, indirectly, by speech and gesture; but it also takes place directly, by telepathy; "on the failure of the primitive linin-network to embrace and tie the human aggregates together, the psychic counterparts of the nerve energies have become the chief factor in connecting the units." So we are necessarily led to consider the part played by the psyche in organic evolution; and the author concludes that it "does not take part in the actual machinery as any primary essential part of the mechanism, but, as the machinery becomes complicated, it plays an important part in simply heightening or dampening down the stimulus." At the same time, the psyche, having emerged, fills a larger and larger portion of man's life, and the life of the future will probably be "the result of the interplay of the specially developed psychic organism with a psychic environment." Even, then, if further morphological transformation is impossible, we have every reason to think that a sixth period will start on a higher level of life, altogether beyond our present comprehension.

It is something of a relief to turn from these highly speculative discussions to the inductions and experiments of Professor Punnett's *Mendelism*. The book, which is written in a style as popular as the subject allows, consists of fifteen chapters: the Problem, Historical, Mendel's Work, the Presence and Absence Theory, Interaction of Factors, Reversion, Dominance, Wild Forms and Domestic Varieties, Repulsion and Coupling of Factors, Sex, Intermediates, Variation and Evolution, Economical, Man. The treatment offers, if compared with Mr. Bernard's work, a good illustration of the difference between hypothesis and speculation. The *Mendelism* may be cordially recommended, as an admirable introduction to the present problems of heredity: aside from a slip in botanical nomenclature (p. 2 and elsewhere), there is little if anything for the critic to carp at. The final chapter, with its remark that "the analysis of mental characters will no doubt be very difficult," is a direct challenge to the experimental psychologist.

On Certain Electrical Processes in the Human Body and their Relation to Emotional Reactions. By F. L. WELLS and A. FORBES.

An Empirical Study of Certain Tests for Individual Differences. By M. T. WHITLEY.

Archives of Psychology, nos 16, 19. New York. The Science Press. 1911. pp. 39; iii., 146.

Both of these Studies contribute to our knowledge of problems that are at present under general discussion. The work of Messrs. Wells and Forbes appears almost at the same time with that of Radecki in the *Archives de Psychologie;* and it is reassuring to find a substantial

agreement in results. Wells and Forbes refer the psychophysical galvanic reflex to "the secretion of sweat, which manifests itself physically in two ways, by changing the electrical potential of the surface of the body and by lowering the resistance of the skin." Radecki finds, similarly, a change of potential at the surface and an increased conductivity of the body as a whole; he refers the former to secretory, the latter to circulatory changes; but he adds that the two physiological processes are interdependent, to the extent that each one may be the indirect cause of a physical phenomenon depending directly on the other. Wells and Forbes say that "as an objective criterion of emotional reaction, the electrical reflex appears distinctly superior to any analogous procedure as yet developed;" they add, however, that variations in the susceptibility of a given individual at different times are hardly less than those between different individuals. Radecki also concludes that the reflex is the most delicate test of the emotive factor in mental processes as yet discovered; and he appends a like qualification, though the conditions of his work lead him merely to restrict the application of the test to the individual. It is clear, then, that we are well on the way towards an understanding of the reflex and that, with the improved methods and instruments now becoming available, we may hope to secure a reliable objective index of the presence of affective processes in consciousness.

Miss Whitley reports 45 tests on 3 to 7 subjects, discussed with a view to correlation, change under brief practice, and reliability of the single trial; and 5 very different tests on 9 subjects, discussed from the point of view of change by practice (of the adequacy of 'mean curves' for tests and for persons subjected to them). On the basis of these results, she considers a number of objections raised against various modes of test-procedure. (1) 'A simple test tells us very little of its subject.' But descriptive notes may be taken during performance, and careful selection will render even a simple test significant. (2) 'A single trial is unreliable.' True: not only because of its singleness, but also because of other, variable factors. Few tests frequently administered give the best estimate of the individual and the best basis for comparison. (3) 'The result of the first few trials measures, not the function under test, but adaptability to novel conditions.' The objection is not of weight. (4) 'Tests measure previous similar experience rather than actual capacity.' But this holds of all mental measurement; and the inference is, simply, that tests should be repeated at stated intervals. (5) 'Results are misleading.' True, if only one form of measurement is employed; not if the measurements are treated in various possible ways. (6) 'Practice is individual, both for person and for process tested.' But there is a general law of improvement; and characteristic variability or consistency of performance is precisely what the tests will disclose.

L'Analyse physiologique de la perception. Par E. ABRAMOWSKI. Collection de psychologie expérimentale et de métapsychie, XX. Paris, Bloud et Cie. 1911. pp. 120.

Every 'state of consciousness,' the author tells s, is correlated with 'a group of active physiological elements, nervous and other.' Thus the unitary 'state of consciousness' that we call the visual perception of an object is correlated with a group of sensorial elements, peripheral, subcortical and cortical, whose activity conditions the externalised totality of sensible qualities; a group of mnesic elements in the frontal lobes, which give recognition, make the object par-

ticular; a group of coenaesthetic elements, which add affective tone; and a group of elements simultaneously excited through other sense-organs, which bring no consciousness of their own, but nevertheless influence our experience (*manière de sentir*) of the conscious perception. By the excitatory effect of group upon neighboring group, and the inhibitory effect of new upon precedent activity, four kinds of change take place in the physiological correlate: a new group is associated to a pre-existing group (subjective variation in perception, judgment); part of a group remains active, while the remaining part lapses from function (dysgnosia, resulting from fatigue of attention); part of a group lapses, while the remaining part is associated to a new group (association of ideas); and the association of a new group arrests the function of the pre-existing group (sudden emotion, suggestion). Furthermore, all nervous activity is reducible to a nutritive reaction. And as this metabolic process extends beyond the nervous system to other tissues, the entire organism divides, at a given conscious moment, into a part that is living or active, and a part that is dormant or inactive; so that, in the wider sense, the whole of the 'living' part is the correlate of consciousness. What this living part is, in detail, must be made out by application of the method of concomitant variations.—

The author is, no doubt, right in his insistence upon the very great complexity of the neural counterpart of such a process as perception. He does good service, also, in calling attention to the peculiar change in perception that results from change of mood; things do seem actually to 'look brighter,' to assume a greater luminosity and a more vivid coloring, when we are, *e. g.*, joyfully expectant. On the other hand, his underlying doctrine of assimilation and dissimilation, his theory of feeling, and his classification of mental processes, are all open to criticism; too little is known, whether of nervous system or of mind, for such theorising to command acceptance.

Handbook of American Indian Languages. By F. BOAS. Part I. Washington, Govt. Printing Office. 1911. pp. vii., 1069. Bureau of American Ethnology, Bulletin 40, pt. i.

Indian Tribes of the Lower Mississippi Valley and Adjacent Coast of the Gulf of Mexico. By J. R. SWANTON. Washington, Govt. Printing Office. 1911. pp. vii., 387. Bulletin 43.

Indian Languages of Mexico and Central America and their Geographical Distribution. By C. THOMAS, assisted by J. R. SWANTON. Washington, Govt. Printing Office. 1911. pp. vii., 108. Bulletin 44.

Preliminary Report on a Visit to the Navaho National Monument, Arizona. By J. W. FEWKES. Washington, Govt. Printing Office. 1911. pp. vii., 35. Bulletin 50.

Antiquities of the Mesa Verde National Park: Cliff Palace. By J. W. FEWKES. Washington, Govt. Printing Office. 1911. pp. 82. Bulletin 51.

The first work upon this list had its inception in an attempt to prepare a revised edition of the Introduction to the Study of Indian Languages by the late Major J. W. Powell. The present volume contains sketches, by competent hands, of ten languages of the northern group: the Athapascan, Tlingit, Haida, Tsimshian, Kwakiutl, Chincook, Maidu, Algonquian, Siouan and Eskimo. The Introduction, by Professor Boas, discusses Race and Language, the Characteristics of Language,

Classification of Languages, Linguistics and Ethnology, and Characteristics of American Languages. The intention of the whole is to "describe as clearly as possible those psychological principles of each language which may be isolated by an analysis of grammatical forms," and a full discussion of "the essential psychological characteristics of American languages" is promised for the end of the second volume. Whether this selectively psychological treatment will be of greater service to psychology than a complete linguistic exposition, an objective record which every psychologist might use independently for himself, remains to be seen. If, however, it is allowable to judge by the material before us, enough will be offered to afford a critical basis whether for agreement or for dissent. It is impossible to praise too highly the care with which the book has been compiled and printed.

The greater part of Dr. Swanton's work is devoted to the Natchez group, and contains valuable information as to customs, mythology, and religion. It is interesting to note the settlement, by new evidence, of the controversy regarding the Taënsa grammar which raged in the eighties of the last century. "If the language in the work under discussion was ever a living speech it was not that of the Taënsa; and since, in consequence, the texts, containing as they do references to this tribe, must have been the work of white men, we may conclude with probability that the whole of the material had the same origin and is entirely fraudulent" (p. 24).

Drs. Thomas and Swanton have prepared a linguistic map of Mexico and Central America, which has been revised by a number of authorities, and is here printed "as an attempt to represent the present state of knowledge regarding a subject which may never be cleared entirely of obscurity." The two remaining *Bulletins* upon our list are of an archaeological character.

The Conflict of Naturalism with Humanism. By W. Goodsell. *Spinoza as Educator.* By W. L. Rabenort. Teachers' College, Columbia University, Contributions to Education, Nos. 33, 38. 1910, 1911. pp. 183, 87.

For Humanism, the significance and worth of the universe rest in their relation to the life of man; for Naturalism, human life, as well as all phenomena that penetrate man's experience, are explicable by reference to natural forces, operating throughout the universe to produce unvarying sequences of events. These world-attitudes were clearly outlined by the Greeks; re-emerged during the intellectual ferment of the Renaissance; attained a clearer definition in the 17th and 18th centuries; and are found in conscious opposition in the 19th. They may be reconciled by way of Pragmatism, "a philosophy of life which combines the devotion to facts characteristic of the naturalist with that reverent faith in ideal values which marks the humanistic creed." Mr. Goodsell's essay traces the historical development of the opposing theories; shows the influence of their opposition upon the educational theory and practice of different periods; outlines the pragmatic reconciliation; and suggests the implications of this pragmatic synthesis for a philosophy and art of education. He has read widely, but makes no reference to Ward's 'Naturalism and Agnosticism'

Spinoza looked upon education as a natural process, since it is in harmony with the developing character of the universe; as a necessary phenomenon, since God and Nature would be different without it; and as a free activity, since it goes on in accordance with the

nature of the being educated. The possibility of education thus granted, Mr. Rabenort shows us Spinoza's view of the elements of human nature, and sets forth his doctrine of the supremacy of the intellect. The author then turns to the complications of personality; individuals differ, and individuals also unite to form social groups. So we arrive at the criteria of education; Spinoza accords priority to social intercourse and the preservation of life and health. The general aim of the essay is to prove, by exposition and full quotation, that the omission of Spinoza's name from the roll of philosophers who figure in the History of Education is unjustified; the author hopes that, the hint once given, the bearing of the Spinozistic philosophy upon education will attract the labor of other hands.

"Obscene" Literature and Constitutional Law: a forensic defense of freedom of the press. By T. SCHROEDER. Privately printed for forensic uses. New York, 1911. pp. 439.

The Social Evil in Chicago: a study of existing conditions with recommendations by the Vice Commission of Chicago. Chicago, Gunthorp-Warren Printing Co., 1911. pp. iii., 399.

Report of the Vice Commission of Minneapolis to His Honor J. C. Haynes, Mayor. Minneapolis, Press of H. M. Hall, 1911. pp. 134.

The Answer. By W. J. CHIDLEY. Melbourne, The Australasian Authors' Agency. 1911. pp. 79.

The first of these volumes, which consists in the main of articles already printed in popular, medical and legal journals, argues, as its title implies, that the existing postal and other laws against 'obscene and indecent' literature are unconstitutional, and that the resulting suppression of information is contrary to public welfare. Its subject-matter is therefore of sociological rather than of psychological interest; we note, however, that it contains a psychological and ethnological discussion of Modesty, the results of which are in substantial agreement with those of the best modern authorities.

The next two books,—the one of them was at one time forbidden the mails; so that, in its case at any rate, Mr. Schroeder's protest is justified and timely,—are also sociological in character; the Chicago Report contains data of some importance for social psychology.

The question which Mr. Chidley seeks to answer is that propounded by Montaigne: "What has rendered the act of generation, an act so natural, so necessary and so just, a thing not to be spoken of without blushing, and to be excluded from all polite discourse?" The answer, freed of all irrelevancies, is this: The act has been misunderstood, popularly and scientifically. The author's view is a physiological, not a psychological hypothesis; we give it mention because he declares that for many years he sought, in vain, to publish a book on the subject. We suspect that the failure to find a publisher is due less to the nature of the subject itself than to the apparently extravagant theories and inferences with which Mr. Chidley invests it.

An Outline of Individual Study. By G. E. PARTRIDGE. New York, Sturgis & Walton Co., 1910. pp. v., 240.

This little book suffers from two disadvantages: the first, that it appeared in the same year with Whipple's far more elaborate *Manual of Mental and Physical Tests;* the second, that it bears a curiously

misleading title. To those who know beforehand nothing of its contents it must suggest an outline for self-education, a sort of correspondence-course in book form; to those who are acquainted with its purpose, it must suggest a comparison with Whipple's larger work. For it is, in fact, not an outline of individual study, but an outline of the study of individuality, a guide to the teacher who wishes to acquire a sympathetic and intelligent understanding of the character, temperament, and latent possibilities of the pupil. Its aim is thus more general and its treatment more elementary than those of Whipple; it may be used in schools that do not yet possess the equipment for a formal course in mental and physical tests; even where such a course is given, it may serve, as collateral reading, to give a broad perspective; and it will be of real aid to the Normal School graduate who is called upon to conduct, with small means and with less experience, a first examination of the children under her care.

Pt. i., on the history and theory of individual study (i. e., study of individuals), is of minor importance. Pt. ii., on the practical study of individuals, and Pt. iii., on the application and results of individual study, are the really useful portions of the work. The topics discussed are health, bodily characters, measurements of the body, movements, mental traits, emotions, interests and instincts, senses and perception, memory and association, free mental activity (imagination), and purposive thinking; there follows a statement of the results obtained by the application of the methods described to two children, identical twins, brought up in the same surroundings, but grossly differentiated by the fact that the one had suffered an attack of brain fever.

A valuable feature of the book is the vocabulary of terms denoting mental traits (pp. 106-111, 118).

Justice and Happiness. By W. BENETT. Oxford, The Clarendon Press. 1911. pp. 140.

The first of the two essays which make up this little volume is concerned with the definition of Justice, and the application of the concept as defined to various social problems. All justice, the author finds, is either retributive or distributive, and the guiding principles under both heads are personal equality, and desert or equality of value. In retributive justice, rewards and punishments are governed entirely by desert, and the position of the parties before the law, by personal equality. Distributive justice is a compromise between equality of persons and equality of deserts; perhaps, more correctly (in view of the way in which the original principle of equality of desert has been obscured by history), between personal equality and personal inequality. Genetically, justice, like the social habit itself, is an immediate product of the necessities of man's position in the world; it has its root in prehuman instincts. Justice owes its steady preeminence among ethical values to the fact that it is by far the most important condition of freedom; and freedom may be defined as the political and social conditions which secure the greatest possible evolution of power towards the realisation of a national end, which is also ethically valuable.

From Justice the author passes to Happiness. Justice is the primary condition, not of happiness generally, but of all that makes happiness worth having; for Justice necessarily conditions freedom, freedom conditions forward evolution, and forward evolution determines the ethical value of happiness. After a psychological char-

acterisation of happiness, and a negative discussion of its intrinsic ethical value, we proceed to the question whether the pursuit of happiness, for oneself or for others, has ethical value. The outcome is again negative: "we never find happiness as a feature of any one of the concrete ideals which men set up for their reverence." In general, the end of action and the object of desire, in conduct which has an ethical value, are always distinct; the end of action is something which, in itself, is neither desirable nor undesirable; and the more completely the distinction is carried out, the higher is the value of the action.

Zur Lehre vom Gemüt. Von J. REHMKE. Zweite, durchgearbeitete Auflage. Leipzig, Dürr'sche Buchhandlung. 1911. pp. viii., 115. Price Mk. 3.00.

Professor Rehmke here outlines his systematic psychology of Feeling. Freed from the technicalities of his *Lehrbuch*, the doctrine is substantially as follows: Feeling is subjective (*zuständlich*) as opposed to presentation which is objective (*gegenständlich*), though it never appears without objective accompaniment. It is determined by the whole group of presentations, clear or obscure, that constitute the objectivity of a particular consciousness; its mode, as pleasant or unpleasant, depends upon the standard (*massgebend*) presentation, *i. e.*, upon the presentation which occupies the focus of attention; its intensity depends upon the 'affective values' of all coexistent presentations. Since it is correlated with the totality of given presentations, it cannot appear as 'mixed;' neither has it a variety of qualities, within pleasantness and unpleasantness; and though every presentation has 'affective value,' this is by no means to be confused with the doctrine of an attributive 'affective tone.' What is known as the 'coloring and shading' of feeling is a matter, not of feeling itself, but of concomitant presentation, of 'somatic sensation.' The James-Lange theory is right in its insistence that certain bodily changes are among the conditions of feeling; but it is wrong in identifying the sensations connected with these changes and the sensations connected with the 'expression' of feeling; the 'expression' results from the feeling; and the two groups of somatic sensation, concomitant and successive, must be sharply distinguished. Mood is an affective complex whose 'standard' presentation is somatic sensation. Emotion is an affective complex whose subjective side is always intensive pleasantness or unpleasantness, and whose 'concomitant' somatic sensations are also highly intensive; its 'standard' presentation is never somatic sensation. *Gemüt* is either a collective term for feelings and moods, or is the particular conscious (or psychophysical) condition of the *Gemütszustand* (feeling, mood, etc.)

The Universities of Ancient Greece. By J. W. H. WALDEN. New York, C. Scribner's Sons, 1909. pp. xiv., 367.

The period treated in this interesting little book is the first five centuries of the Christian era; so that Greece includes, besides the Balkan peninsula and the islands of the Aegean and eastern Mediterranean, Egypt and the adjoining parts of Libya, Asia Minor with Syria, Palestine and Arabia Petraea, Thrace, and Macedonia. In order to give historical perspective, a short account has been prefixed (under the headings Education at Athens in the fifth and fourth centuries B. C., The Macedonian period, Education and the State) of the Athenian education in pre-Alexandrian times, and of the conditions

which prevailed in Grecian lands in the last three centuries B. C. The body of the work sets forth the establishment, history and decline of university education, and the appointment, number, pay and social position of professors; discusses the subject-matter and methods of sophistic teaching; traces the career of a student, in boyhood, at the university, and during the years of struggle for a professional appointment; and informs us regarding public displays, schoolhouses, holidays, etc. The ideal of education in these centuries, as formulated by the emperor Julian, and endorsed by teachers like Libanius and Themistius, "received its embodiment in the man who had been trained, morally, intellectually, and aesthetically, to use his powers in the interest of the State. Such a man was the orator. The orator was not the man of fluent tongue and graceful speech solely; nor was he the man of scientific attainments or technical knowledge; he was the man of broad learning and general culture, trained to see the distinctions of right and wrong, and to act with reference to them in the service of his native city."

The book is written in an agreeable style; and though the intending reader may be disposed to cavil at the technical word 'universities,' he soon learns that the writer has reason for its employment, and that the exposition rests upon a solid basis of scholarship.

Die geistige Ermüdung: eine zusammenfassende Darstellung des Wesens der geistigen Ermüdung, der Methoden der Ermüdungsmessung und ihrer Ergebnisse, speciell für den Unterricht. Von M. OFFNER. Berlin, Reuther & Reichard, 1910. pp. vi., 88.

Mental Fatigue: a comprehensive exposition of the nature of mental fatigue, of the methods of its measurement and of their results, with special reference to the problems of instruction. By M. OFFNER. Translated by G. M. WHIPPLE. Baltimore, Warwick & York, 1911. pp. viii., 133. 'Educational Psychology Monographs.'

Das Gedächtniss: die Ergebnisse der experimentellen Psychologie und ihre Anwendung in Unterricht und Erziehung. Von M. OFFNER. Zweite, vermehrte Auflage. Berlin, Reuther & Reichard, 1911. pp. xi., 258.

"This translation," says Professor Whipple in his Preface, "has been undertaken because the monograph collates, systematizes, and appraises a mass of scattered and to most readers inaccessible material that bears upon a schoolroom question of unquestioned importance." The sentence sums up the character of Dr. Offner's work upon mental fatigue, and gives the reason for the warm welcome that it has received in Germany and for the undertaking of a translation into English. We may add that the author has made alterations and additions which practically constitute the American book a second edition, and that the translator has extended the bibliography of the original, and also added an appendix on the terminology of the German school system.

The first edition of the *Gedächtniss* was reviewed in this JOURNAL, XX., 457. The fact that a second edition is called for within two years of the date of publication speaks for itself. The author has simplified his exposition wherever possible, has defined more sharply and insistently his attitude to psychology, and has brought the book down to date both on the side of theoretical and on that of applied psychology.

Mental Fatigue: a comprehensive exposition of the nature of mental fatigue, of the methods of its measurement and of their results, with special reference to the problems of instruction. By M. OFFNER. Translated by G. M. WHIPPLE. Baltimore, Warwick & York. 1911. pp. viii., 133.

Psychology and Pedagogy of Writing: a résumé of the researches and experiments bearing on the history and pedagogy of writing. By M. E. THOMPSON. Baltimore, Warwick & York. 1911, pp. 128.

When Should a Child Begin School? An enquiry into the relation between the age of entry and school progress. By W. H. WINCH. Baltimore, Warwick & York, 1911. pp. 98.

Spelling Efficiency in Relation to Age, Grade and Sex, and the Question of Transfer: an experimental and critical study of the function of method in the teaching of spelling. By J. E. W. WALLIN. Baltimore, Warwick & York, 1911. pp. viii., 91.

These are the first four monographs issued in connection with the Journal of Educational Psychology. Professor Whipple's translation we mention elsewhere, in connection with its German original. Miss Thompson's essay on Writing is avowedly a compilation; but it is made by a competent and experienced teacher, and will no doubt do good service. The net outcome of Mr. Winch's investigation is that children should enter school at five years of age: to enter between three and five confers no advantage, at the time or later, in grade of work performed, in behavior, or in training of the attention; to enter after five may mean retardation. Dr. Wallin emphasizes the necessity of rational drill in spelling, and finds that the ability to spell words given in vocabulary form is, with very slight loss, available in written compositions. He advocates a liberal appeal to various types of imagery, but recognises that the psychology of this matter has not yet been adequately worked out.

A Beginner's History of Philosophy. By H. E. CUSHMAN. Vol. I., Ancient and Mediaeval. pp. xxi., 406. Vol. II., Modern Philosophy. pp. xix., 377. Boston, New York, Chicago; Houghton Mifflin Co. 1910, 1911.

Theories of Knowledge: Absolutism, Pragmatism, Realism. By L. J. WALKER, S. J. London; Longmans Green and Co. 1910. pp. xxxix., 696.

Abriss der Geschichte der Philosophie. Von C. J. DETER. Ninth edition, revised by M. FRISCHEISEN-KOEHLER. Berlin; W. Weber. 1910. pp. vi., 178.

These works fall beyond the sphere of interest of a Journal of Psychology, and we are therefore not able to give them the space that they deserve. Professor Cushman has produced a most readable student's introduction; the exposition is set upon a background of geography and literary and political history; the treatment in the main follows the lines laid down by Windelband. Those of us who were introduced to philosophy by way of Schwegler can only envy the present generation of students, who find a book like this at their disposal; the author plainly possesses marked pedagogical ability. Professor Walker gives us an elaborate criticism and analysis of the theories of knowledge named in his title; the claims of scrupulous impartiality, wide knowledge, and intelligent and judicious consideration of problems.

put forward on the author's behalf by Professor Maher, seem to be fully justified. Whether the main thesis of his work, that Realism affords the needed synthesis of Absolutism and Pragmatism for current philosophical thinking, is sound or not, is a question which must be left to specialists to decide. The little *Abriss* of Deter is probably familiar to all Americans who have taken a philosophical or theological degree at Berlin. The present edition has been rearranged and brought down to date by. Dr. Frischeisen-Köhler, on the basis of Dilthey's *Grundriss der Geschichte der Philosophie.*

The Oriental Religions in Roman Paganism. By F. CUMONT. With an Introductory Essay by G. SHOWERMAN. Chicago, Open Court Publishing Co., 1911. pp. xxv., 298.

This book contains eight lectures, delivered by Professor Cumont in Paris and Oxford, which trace the transformation wrought in the religion of Rome, under the unifying influence of neo-Platonism, by the successive introduction of Oriental cults and mysteries. The lectures are entitled: Rome and the Orient, Why the Oriental Religions Spread, Asia Minor, Egypt, Syria, Persia, Astrology and Magic, The Transformation of Roman Paganism; the volume ends with some 75 pp. of notes, mostly bibliographical. We begin with a comparative picture of east and west; we are shown how the eastern religions, carried by merchants, soldiers, slaves, appealed to the senses, the intelligence and the conscience of the Roman; we are then told in detail how Cybele came from Asia Minor, Isis and Serapis from Egypt, Iasura and the many Baals from Syria, Mithraism from Persia; till we finally understand how, "by means of compromises between old Oriental ideas and Greco-Latin thought, an *ensemble* of beliefs slowly took form, the truth of which seemed to have been established by common consent." One result stands out clearly: that Christianity was not a sudden and miraculous change, but a composite of long and laborious growth: "the faith of the friends of Symmachus was much farther removed from the religious ideal of Augustus, though they would never have admitted it, than that of their opponents in the Senate." The book is a popular presentation of a great subject, by a scholar who is admirably equipped for the task.

Die Weltanschanungen der grossen Philosophen der Neuzeit. Von L. BUSSE. Fourth edition, by R. FALCKENBERG. Leipzig, B. G. Teubner, 1909. pp. viii., 156. 'Aus Natur und Geisteswelt,' Bd. 56.

Professor Falckenberg has wisely retained the plan and arrangement of this excellent little book. There is an introduction on the nature and problem of philosophy, and the problem of a history of philosophy. Then follow two main sections, covering modern philosophy to and after Kant; each is introduced by a general characterisation of the period. Then, under classificatory chapter-headings (Rationalism, Neo-Kantianism, etc.), come outline sketches of the systems of the great philosophers: first, a condensed biography; next, a list of the subject's principal works, and a couple of references to critics and commentators; last, the leading features of the system itself, with a sufficiency of back-and-forth reference to give a careful reader his perspective. The summaries are carefully and clearly written; witness the five pages that sum up the philosophy of Hegel! —It may be noted that the discussion is, for reasons of space, con-

fined to metaphysics, epistemology and ethics. Noteworthy, too, in the light of certain 'objective' methods of psychology, is Professor Busse's remark that philosophical systems cannot be measured by the yard:" a very important system, built on large lines, may be briefly summarised; a relatively unimportant system, because it is more complicated and less definitely organised, may demand a greater number of pages.

The Life and Letters of Martin Luther. By P. SMITH. Boston and New York, Houghton Mifflin Co. 1911. pp. xvi., 490. With illustrations. Price $3.50 net.

"The present work aims to explain [Luther's] personality; to show him in the setting of his age; to indicate what part of his work is to be attributed to his inheritance and to the events of the time, but especially to reveal that part of the man which seems, at least, to be explicable by neither heredity nor environment, and to be more important than either, the character, or individuality. A new biography of Luther, however, requires . . . apology. . . . One reason [for the present work] is to be found in the extraordinarily rapid advance of recent research. . . . In another respect [the book] undertakes to present Luther to English readers from a standpoint different to that from which he is usually approached. I have endeavored to reveal him as a great character rather than as a great theologian. In order to do this I have given copious extracts from his table-talk and letters, those pregnant documents in which he unlocks his heart." So the author in his preface. He has produced an interesting and, so far as the layman can judge, a thorough piece of work.

BOOK NOTES

Aus dem Werdegang der Menschheit, von H. v. BUTTEL-REEPEN. Jena, Gustav Fischer, 1911. 139 p.

This work, which has 108 illustrations, has grown out of a simple lecture in which the author attempted in untechnical terms to set forth the various stages of human development. Beginning with the Neanderthal skull, he proceeds to the discussion of Eoliths, Anthropopithecus, the Heidelberg man, the ice age, the stone and bone work of Diluvial man, the men of the French caves, development of primates, the art of primitive man, beginnings of agriculture, etc.

Criminal man according to the classification of Cesare Lombroso. Briefly summarized by his daughter Gina Lombroso-Ferrero, with an introduction by Cesare Lombroso. New York, G. P. Putnam's Sons, 1911. 322 p.

This is a very convenient summary of the opinions of this distinguished man. The first part treats of the criminal world, the born criminal, his relations to moral insanity, insanity, epilepsy, insane criminals and criminaloids. Part two treats of crime, its origin, cause and cure, including prevention and repression; Part three, characters and types of criminals, their examination, the chief forms of crime, distinctions between criminals and lunatics and in an appendix is a brief summary of Lombroso's important works.

Geschichte der Psychologie, von OTTO KLEMM. Leipzig, B. G. Teubner, 1911. 388 p. (Wissenschaft und Hypothese VIII.)

This little book is divided into the following sections: the general direction or drifts of psychology, metaphysical and empirical. The second section discusses the development of the fundamental ideas of psychology tracing their development one by one and the third, the history of the most important psychological theories.

Heredity in relation to evolution and animal breeding, by WILLIAM E. CASTLE. New York, D. Appleton & Co., 1911. 184 p.

This little book is based on a course of eight lectures delivered in the fall of 1910 at the Lowell Institute and elsewhere. It treats of genetics in general, the duality of inheritance, germ plasm, Mendel's law, the determination of dominance, the evolution of new races by loss or gain of characters, also by variation of their potency. It discusses whether Mendelian unit characters can be modified by selection, the effects of inbreeding, heredity and sex.

The grades of life. Edited by M. Sopote. Oxford, 1909. 37 p.

This pamphlet is based upon the idea of Pascal that since we often dream that we dream, heaping up one dream upon another, it is therefore quite possible that this life itself is but a dream on which the other dreams are grafted and from which we wake at death. Upon this striking passage the author, M. Sopote, B. Sc. Oxon, bases his conjectures which are set forth in the form of 37 letters.

The Goulstonian Lectures on the sensibility of the alimentary canal, by ARTHUR F. HERTZ. London, Henry Frowde, 1911. 83 p.

The author believes that no branch of medicine has made greater progress in the last fifty years than that which deals with the diseases of the alimentary canal. The great step in advance was made by Brinton in 1858. Then, fifteen years later, came Kussmul, who introduced lavage into gastric therapeutics, and Leube, who extended the use of the stomach tube to diagnosis as well as treatment. These methods are comparable in opportunity to that of examining the urine in diseases of the kidneys. Later Adolf Schmidt has shown what valuable data the examination of the faeces can yield to disturbance of intestinal digestion. As our knowledge of chemical functions was revolutionized a couple of decades ago by the introduction of test meals, so now the X-ray and stomach pump have added very greatly to knowledge and resources. It is impossible to understand the origin of pathological sensations while the law of healthy organs to various stimuli is unknown and much that has been written upon visceral sensibility is purely theoretical. The author discusses in the several chapters of his book tactile, thermal and chemical sensibility, the sensations of fullness and distension, of emptiness and hunger, pain and variations in the sensibility of the canal.

Man, king of mind, body and circumstance. By JAMES ALLEN, New York, Thomas Y. Crowell & Co., 1911, 55 p.

This book treats of the inner world of thoughts, the outer world of things, habits, its slavery and its freedom, bodily conditions, spiritual domination, conquest not resignation.

Asthetik, von RICHARD HAMANN. Leipzig, B. G. Teubner, 1911. 120 p. (Aus Natur und Geisteswelt.)

This little work discusses the essence of aesthetical experience, its modifications, its elements, the extra aesthetic content, categories and finally, the essence of style.

Elements of physiological psychology, by GEORGE TRUMBULL LADD and ROBERT SESSIONS WOODWORTH. New York, Charles Scribner's Sons, 1911. 704 p.

It is now nearly a quarter of a century since the appearance of the first edition of this treatise (1887). It was, when it was published, the only work of its kind in English or in any other language, save the great work of Professor Wundt then in its second edition. Although there has been a very great development since, the author believes that "it is entirely safe to say that neither the extravagant hopes nor the extravagant fears of 25 years ago with reference to the results of the so-called new psychology have been verified. The fundamental problems with regard to the nature of man's mind and its relations to the organism, its place in the scale of development and destiny remain essentially unchanged." The chief point of evaluation of such a new edition is to know whether it is revised to date. The author says that "there are several important changes" the chief being that this edition is more physiological. Two entire chapters, one on the place of the nervous mechanism and the other on the development of the nervous system have been added to Part I and "all the other chapters of this part have been carefully

rewritten and in most cases considerably expanded." A new chapter on the localization of cerebral functions has been transferred to it. The other chief change is the great reduction in the third part because the author has expressed his views elsewhere, especially in his Philosophy of Mind (1895) and his Theory of Reality (1899).

Body and mind, by WILLIAM MCDOUGALL. London, Methuen & Company, 1911. 384 p.

The author in writing this book has aimed "to provide for students of psychology and philosophy within a moderate compass a critical survey of modern opinion and discussion upon the psychophysical problem, the problem of the relation between the body and mind." Most of the book "is occupied with a survey of modern discussion and modern theories of psychophysical relation." The author pleads for what he calls animism as distinct from the Jamesian transmission or percolation view of things and seeks to give due justice to the evolutionary point of view. The author is satisfied with neither parallelism nor interaction. He holds that not only conscious thinking but morphogenesis, heredity and evolution are psychophysical processes all conditioned and governed by psychic dispositions built up in the course of the experience of the race. So long as this process proceeds smoothly in routine fashion probably the species may go on unconsciously or subconsciously, but nevertheless the circumstances of the organ demand new and more specialized adjustment. Their smooth automatic working is disturbed and the corresponding meanings are brought to consciousness and by conscious perception, thinking and striving the acquired adjustment is effected.

Psychology and pedagogy of writing, by MARY E. THOMPSON. Baltimore, Warwick and York, 1911. 128 p.

This work gives a story of the historical development of the alphabet, résumés of the experiments bearing on the psychology of writing, its pedagogy and a bibliography.

A brief course in the teaching process, by GEORGE DRAYTON STRAYER. New York, The Macmillan Company, 1911. 315 p.

This book is the outcome of experience in trying to help teachers grow in skill in the art of teaching and the power to appreciate the work in which they are engaged. It deals with problems that the teacher faces every day and avoids technology. Its chapters are the aim of education, factors conditioning the teaching process and the process itself, the drill, the inductive and the deductive method, the lesson for appreciation, for study, review, for examination, the recitation lesson, question and social phases of the recitation, physical welfare of children, moral training and class management, lesson plan, teacher's relation to supervision, course of study and measuring results. In a rather elaborate appendix, F. T. Baker schedules the teaching of English, geography and other topics in the elementary schools.

Animal intelligence, by EDWARD L. THORNDIKE. New York, The Macmillan Co., 1911. 297 p.

The author's main purpose is to make accessible to students and others his own experimental studies of animal instinct and behavior.

They have a twofold interest; first, representing the first deliberate and extended application of the experimental method and second, as an introduction to the literature. They mark a change from books of general argumentation to monographs reporting technical experiments. The reports are mainly reprints from the author's work with which all experts are already more or less familiar. The excellent work Professor Thorndike did really marks an epoch and it is a great advantage to have it made accessible in this excellent form. After describing his apparatus, he reports his experiments on cats, dogs, chicks, with his inferences on associations, concepts, habits, attention, etc., and criticisms of previous theories. His note on the psychology of fishes and his study of the mental life of monkeys, his laws on the hypothesis of behavior and the evolution of human intellect are all of great importance, but too well known to need explanation here.

The teacher's practical philosophy, by GEORGE TRUMBULL LADD. Funk & Wagnalls Company, New York, 1911. 331 p.

This book emphasizes the personal and moral element in teaching. The teacher's personality has most to do with the formation of character. This magnifies the office of the teacher. The book is based on the author's lectures given in the Far East. His fifteen chapters are grouped under four heads; the function ,equipment, chief ideals of the teacher and his relation to society and the state.

The psychology of conduct, applied to the problem of moral education in the public schools, by H. H. SCHROEDER. Chicago, Row, Peterson & Company, 1911. 287 p.

This book was not written for specialists but for teachers. It seeks to trace conduct to its sources and to show how the principles of it may be applied to the actual work of teaching. The successive chapters set forth the aim of education, the source of conduct, regard for self and others involving estimation and attachment, benevolence, good will, regard for rights, duty, knowledge, truth, aesthetics and religion. The work is essentially philosophical rather than psychological. It deals with principles and to the casual reader it would seem that it lacks definiteness or application. Judging from his references, the author's reading has been more along general and abstract lines than detailed and specific.

La joie passive, par M. MIGNARD. Paris, Alcan, 1909. 276 p.

This is a study of pathological psychology. The author first discusses euphoria and ecstacy with and without toxins, the satisfied idiots and dements, the condition of satisfaction in general, paralysis in senile dementia, the motor, sensory, organic or vegetative state, the theory of movements and finally, certain practical questions.

Scientific mental healing, by H. ADDINGTON BRUCE. Boston, Little, Brown, and Company, 1911. 258 p.

These essays which had mostly been published elsewhere are here revised and the volume is designed to give the reader a brief yet comprehensive account of the principles underlying psychotherapy, although several chapters that very indirectly relate to this are included.

The author deals with the evolution of mental healing, its principles, methods, with matters of the mind, hypnotism as a therapeutic agent, secondary cells, psychology in every day life, with the history of half a century of psychological research. In such a book one naturally nowadays first looks to see whether the writer has an adequate knowledge of the new Freudian School which to our mind has already written its mene, mene, tekel, upharsin on the wall for the old kind of mental healing which this author has very largely in mind. It is evident that the author has not considered Freud worthy of serious study and he makes some strange statements, e. g., that "scarcely another leading psychopathologist has accepted this sweeping audacious theory" referring to Freud's infantile sex theory. The other allusions to Freud are so very slight and as we might say eccentric, and he is so far from seeing the central idea of Freud that to our mind, his book by this ignorance must be called inadequate to the subject and behind the times, chatty and interesting as it is.

A watcher of the skies, by GUSTAVE F. MERTINS. New York, T. Y. Crowell & Co., 1911. pp. 376.

This is a psychological novel. A young man is at the outset reduced from riches to absolute poverty, loses his wife, a lady whom he had been compelled to marry formally because they had been shipwrecked together for a few days on a desert island. All memory of his past is wiped out by a serious automobile accident so that he begins life again. We are not told much of the stages of the re-education of his second ego, but he appears five or six years later as a young and rather successful physician who had also inherited an immense estate with valuable mines in Mexico and whose secret was known and utilized for his own benefit by a remarkable physician who drew all the revenues from his estate and kept him in his secondary state and was able by imperious domination to hypnotize him at will and make him do his bidding. He also fell in love with the doctor's niece, who knew of his condition. The main interest of the story centers in his depression at realizing that he had lost his real self and in the struggles to get it back. His wife, who had left him, at first, realizes her love for him and appears on the scene, calls him by name, tries in every way to make him remember her but in vain. He was incidentally a marvelous violinist in his primary condition and was able to play marvelously well in his secondary state despite the fear of his master that it would bring him back and therefore deprive him of his income. The doctor, the watcher of the skies, has a marvelous laboratory in the country, where he performs all kinds of mystic experiences with N- and many other rays, surrounding himself with mystery and his estate with spies lest his iniquities should be laid bare by a man who knows them and has come to rescue the hero of the story from his secondary slumbers, from which finally in the denouement he awakes and is reunited to his wife. The plot is a bold one but betrays hardly more knowledge of the psychic phenomena it describes than it does of modern physical science with which it also dabbles much. Thus while we do not attempt to pronounce upon the literary merits of the book, the verdict of those who know what such studies can do must be shrinkingly unfavorable because of the many utterly impossible, not to say preposterous, situations it describes.